RECORDS of the AUCKLAND INSTITUTE AND MUSEUM

Volume 22 18 December 1985

RECORDS
# of the
AUCKLAND INSTITUTE
AND MUSEUM

Volume 22

AUCKLAND, NEW ZEALAND
1985

Editor
K.A.J. WISE

Editorial Committee
Professor Roger C. Green — Anthropology
Dr. H.R. Allen — Anthropology
Professor F.J. Newhook — Botany
Miss Joan Robb — Zoology
Associate Professor G.R. Seaman — Musicology

ISSN 0067-0464
RECORDS OF THE AUCKLAND INSTITUTE AND MUSEUM
Vol. 22 — 18 December 1985

Published by Order of the Council
G.S. PARK, Director

Auckland Institute and Museum
Private Bag, Auckland 1, New Zealand

RECORDS OF THE AUCKLAND INSTITUTE AND MUSEUM
VOLUME 22

CONTENTS

ARCHAEOLOGY AND ETHNOLOGY

Page

Okuratope pa, Waimate, Bay of Islands.
AILEEN FOX 1

The twin-lobed pendant, an Archaic artefact from the Nelson district.
NIGEL PRICKETT 17

Javanese *angklung* in the Auckland Institute and Museum.
ANGELA R. ANNABELL 31

BOTANY

New and interesting records of adventive plants from the Auckland Institute and Museum Herbarium.11.
E. B. BANGERTER 41

ZOOLOGY

The taxonomy of some Indo-Pacific Mollusca. Part 12. With remarks on two American Gastropod species.
W. O. CERNOHORSKY 47

Subfossil bones of a large skink (Reptilia: Lacertilia) from Motutapu Island, New Zealand.
B. J. GILL 69

A new genus and species of Prosympiestinae (Hexapoda:Hemiptera:Aradidae) from Northland, New Zealand.
M. KIRMAN 77

Successful establishment of the Asian mussel *Musculista senhousia* (Benson in Cantor, 1842) in New Zealand.
R. C. WILLAN 85

Lacewings and aquatic insects of New Zealand. 3. Fauna of Poor Knights Islands.
K. A. J. WISE 97

INDEX 105

OKURATOPE PA, WAIMATE, BAY OF ISLANDS

AILEEN FOX

AUCKLAND INSTITUTE AND MUSEUM

Abstract. The pa, Okuratope, near Waimate in the inland Bay of Islands district, is mapped and described. In January 1815, Okuratope was visited by the Rev. Samuel Marsden and J.L. Nicholas who have both left good accounts. At that time an estimated 200-300 people lived at the pa under the chiefs Hongi and Kaingaroa. The historical descriptions are used in interpretation of the archaeological evidence. A sequence of defensive arrangements is suggested.

Okuratope pa near Waimate North enters European history with the visit in January 1815 of Samuel Marsden and J.L. Nicholas in the company of chief Hongi, the joint occupier with his brother, chief Kaingaroa. Both Europeans wrote an account of what they had seen (Marsden 1932:97-100; Nicholas 1817 I:333-41, 349-56), Nicholas' being the more detailed and informative.

Because of its scenic and historic interest the site was acquired as a reserve by the Crown in 1928, the greater part of the land being held in Maori Land Court title by 66 shareholding owners. A narrow corridor for public access across the paddocks from Te Ahuahu Road, a turning off State Highway 1, north of Ohaeawai, was also bought from Mr. H.K. Hatrick and Mr. H. Mountain (*N.Z. Gazette* 1928:1133-4). A *wahi tapu* (burial ground) was subsequently taken out of the reserve at the request of the local Maori people (*N.Z. Gazette* 1929:125) and was fenced off. The purchase was the result of local interest: representations had been made in 1925 by the Waimate North Ratepayers Association, and the Scenery Preservation Board also recommended its acquisition. Okuratope has now been designated a Historic Reserve (*N.Z. Gazette* 1980:3326).

The pa was surveyed in 1932 by L.G. Kelly and his outline plan was reproduced in J.R. Elder's edition of Marsden's Letters and Journals (Marsden 1932:98). The site then and now is covered by heavy bush, mainly secondary growth. I first visited Okuratope with Mr. and Mrs. R. Lawn in April 1973 and quickly appreciated its remarkable qualities and the exceptional preservation of the defences and interior arrangements; here was an example of a ring ditch pa with an occupation securely dated to the early 19th century and closely linked with outstanding historical personages. The need for a detailed and accurate plan was obvious but the dense woodland raised difficulties that could not be overcome by an amateur. The first opportunity of professional assistance came ten years later when Dr Douglas Sutton initiated a three year scheme of excavation and field survey at Pouerua, Ohaeawai (Sutton 1982:183) and employed Janet Leatherby and Peter Morgan to survey the

Rec. Auckland Inst. Mus. 22: 1-15 18 December 1985

crater pa and the extensive Maori field systems. Both had experience of similar archaeological field surveys in Europe and the Middle East and the quality of their work was impressive. With the consent of Dr Sutton, they undertook the survey of Okuratope for three weeks in February 1983, during a break in their employment at the nearby Pouerua complex of sites. Dr Anne Salmond of the Anthropology Department at Auckland University was keenly interested in the project and obtained funds for the survey from the University Research Committee.

The survey was carried out using a theodolite and a self-reducing telescopic alidade. "The method employed was to establish by theodolite a single three point base line running diagonally across the site. The distance between these three points was measured tacheometrically and checked by tape. Ten secondary station points were located with the telescopic alidade from points on the base line. All original drawings were done in the field at a scale of 1:250 and distances were measured tacheometrically, spot heights were taken with the alidade and contours were subsequently added." (J. Leatherby and P. Morgan pers. comm.).

Important discoveries made were an outer line of ditch and defensive scarp on the east side of the pa and an external palisade trench surrounding three sides of the enclosure as well as the remains of terracing and house sites on the ridge to the north west, none of which had been recorded by Kelly.

LOCATION (Figs. 1,2)

Okuratope is an inland pa (Fig. 1) some 20 km from the nearest point on the Bay of Islands coast and 15 km S.W. of Kerikeri (grid reference 368446). It is situated on the northern fringe of a densely populated area in prehistoric times, the Taiamai (Ohaeawai) district with its many Maori pa, including the fortified volcanic cones of Pouerua and Maungaturoto, and with remains of extensive areas of Maori cultivations. The area has close associations traditionally with the growing power of the Ngapuhi tribe in the 18th century, and with their expansion to the Bay of Islands coast in the early 19th century.

The pa itself was built on high ground flanking the upper valley of the Waitangi river at an elevation of over 187 m (600 ft), and towards the end of a spur between two of its tributaries, the Waikuku and Pakonga streams (Fig.2). The site chosen was a flat-topped knob, naturally well defended by very steep slopes. On the easiest line of approach along the ridge from the N.W., the fortifications were skilfully placed to take advantage of the junction of the narrowest part of the ridge with the head of a dry re-entrant valley from the Waikuku stream. To the S.E. the ground falls to a slight declivity before rising again eastwards towards Waimate and merging with the plateau beyond the stream heads.

Marsden and Nicholas' accounts show that they had reached the site from the Waitangi river valley. Their journey began on 9th January 1815 at Rangihoua pa. They travelled in Hongi's carved war canoe to the head of the Kerikeri inlet where they stopped for a hangi and Marsden walked to the falls (Marsden 1932:87; Nicholas 1817 I:321). They proceeded on foot up the river over level land covered in fern,

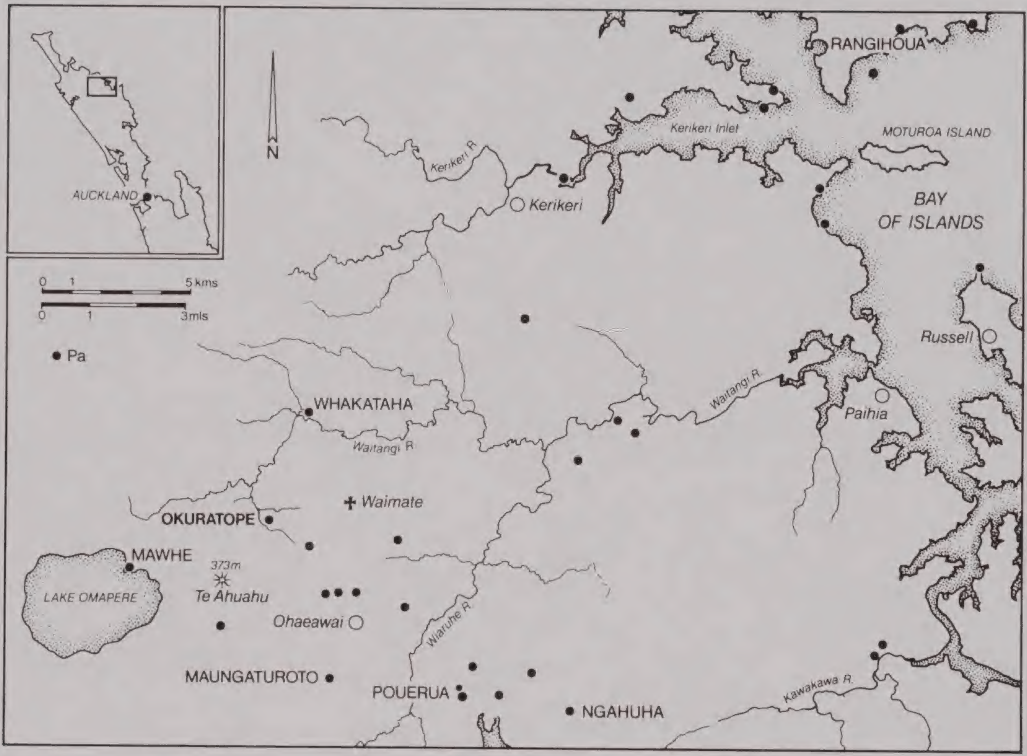


Fig. 1. Location map. Named pa are mentioned in the text; modern place names are in italics. Drawn by M. Rouillard.

crossing six small streams and then into a forest of tawa and totara and over the watershed to the Waitangi river (Nicholas 1817 I:329). They stopped for a meal at "Tariar's" (Tareha's) village on the west bank "with much rich land around it" (Marsden 1932:97). There was a pa belonging to the chief on a lofty hill behind it; this is probably Whakataha (Fig.1), a conspicuous feature in the landscape, now covered in dense bush (grid reference 386489), which was marked as Titore's Mount on NZMS 280 Bay of Islands, 1977. Marsden and Nicholas were carried across the river by the villagers; they then walked across "rugged stony country" for four miles (6.5 km). They passed chief Kaingaroa's plantations on the edge of the forest, finally ascending half a mile (0.8 km) through bush to the summit and arrived at Okuratope, which they knew as "the town of Wyemattee" (Nicholas 1817 I:332-3). The name 'Okuratope' was not mentioned by them. In 1830 the name 'Waimate' was used by Marsden for a native settlement "containing a number of different establishments belonging to different chiefs" (Marsden 1932:471, 473), and presumably refers to the district rather than the pa. Both Marsden and Nicholas commented on the strength of the position

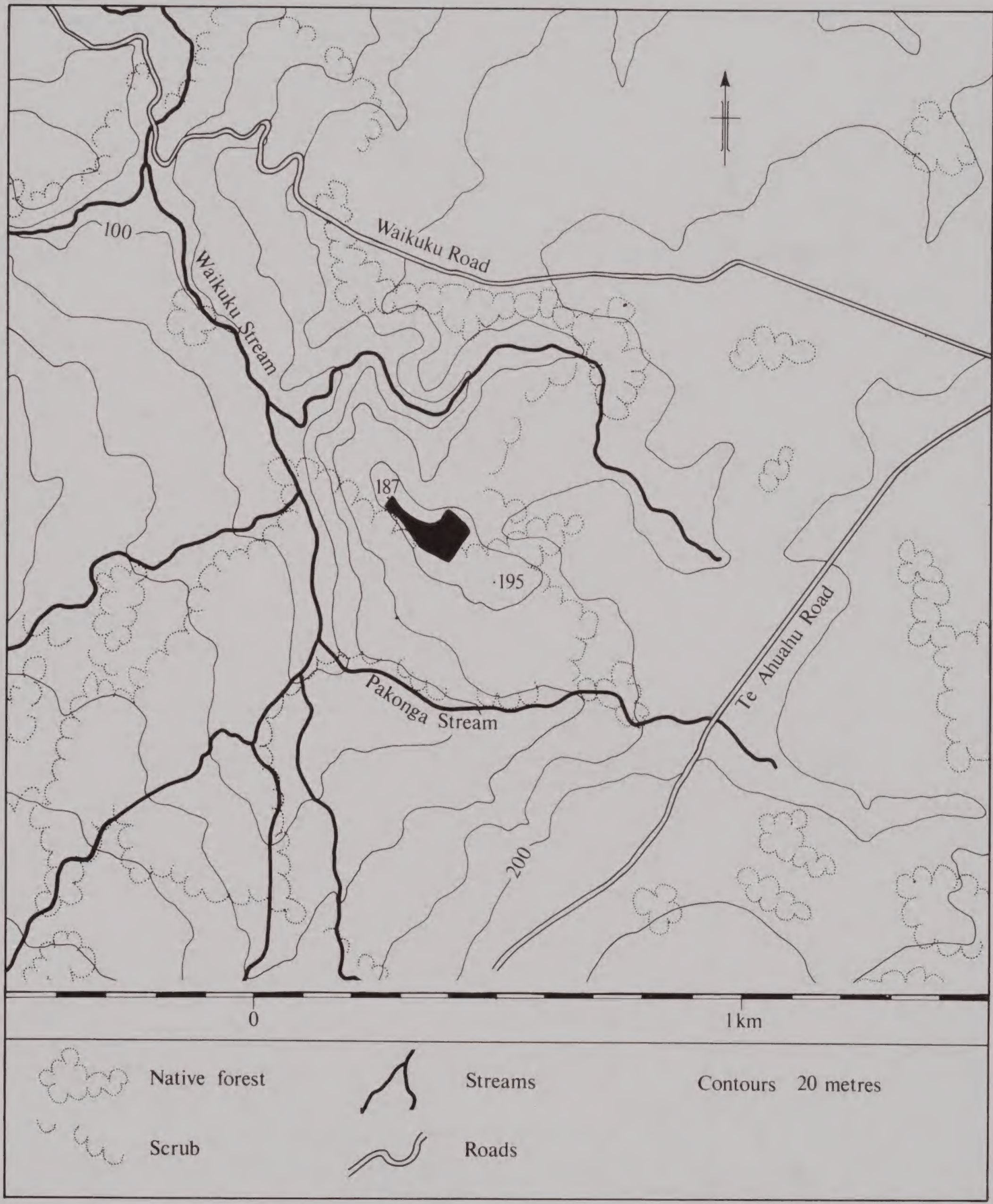


Fig. 2. Okuratope pa in relation to the topography. The area surveyed is shown in black. Drawn by J. Leatherby and P. Morgan.

whilst Nicholas (1817 I:335) added his appreciation of "the sublime scenery, the noble stately forest, the picturesque chequered hills and the distant bold and lofty mountains". The volcanic Te Ahuahu (373 m, 1227 ft) would have been clearly visible 3 km away in the absence of the present woodland (Fig.1).

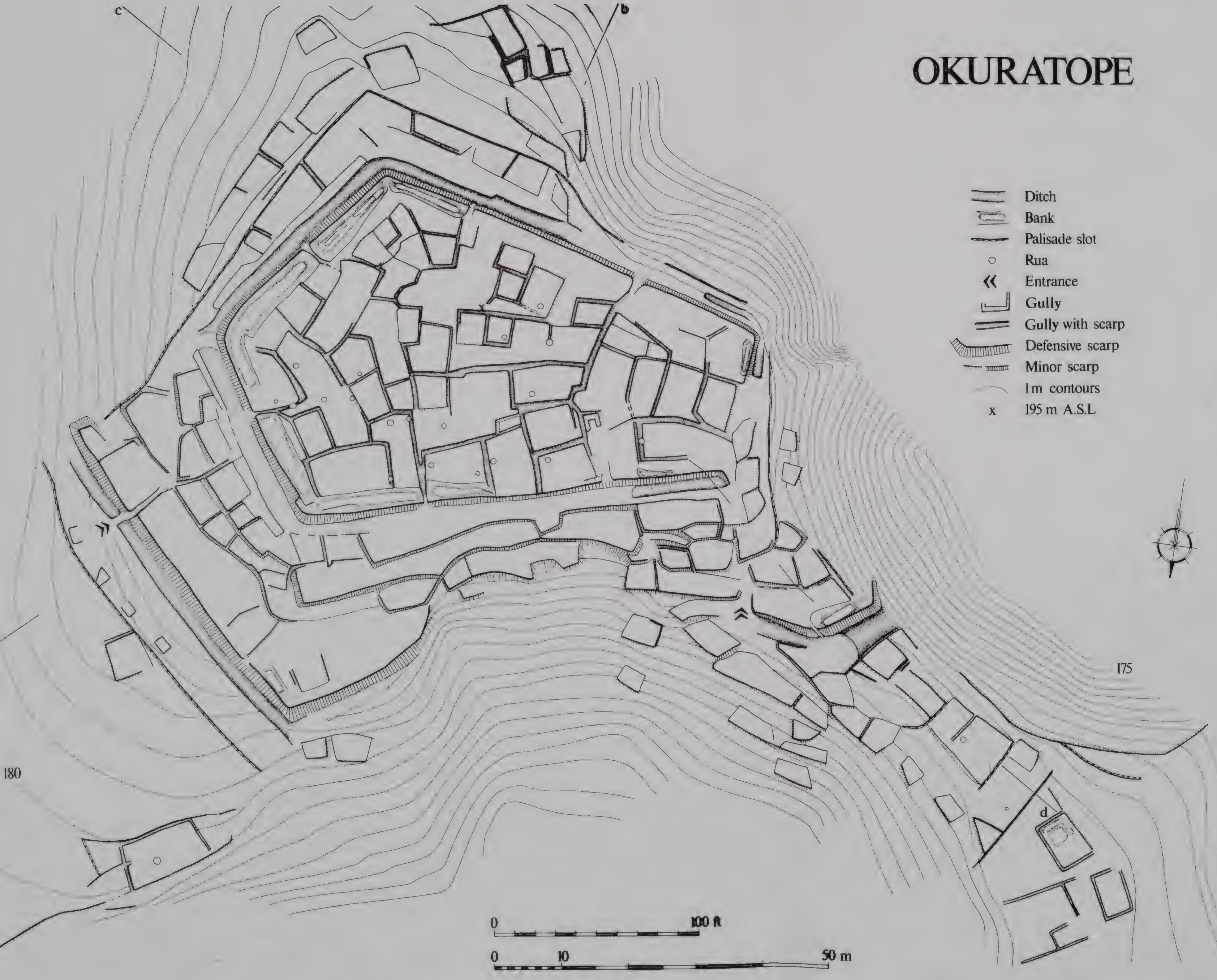


Fig. 3. Okuratope, plan. Surveyed and drawn by J. Leatherby and P. Morgan.

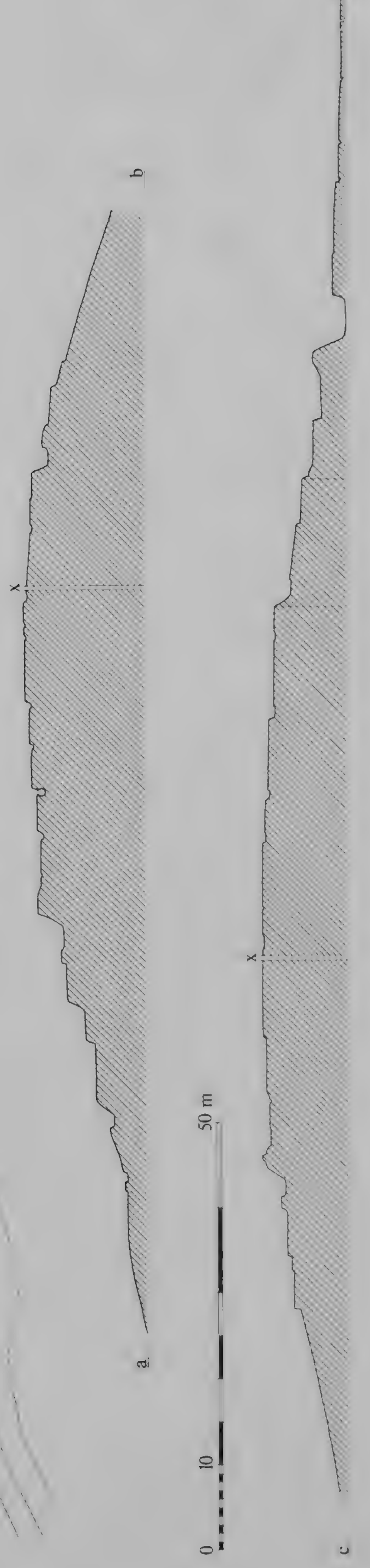


Fig. 4. Okuratope, sections. See Fig. 3 for position.

THE DEFENCES (Figs. 3-5)

The fortifications are described under three headings, the summit enclosure, the cross-ridge defences, and the eastern defences. It is obvious from the complexity of the plan (Fig.3) that the work is of more than one period.

The summit enclosure

The rounded summit of the hill, rising to 190 m at X (Fig. 3) is defended by a continuous scarp 1-2.5 m long, an intermittent internal bank 0.5 m high above the scarp and a flat bottomed shallow ditch 2 m wide, which is discontinuous (Fig. 4). The defences are straightly aligned to form a five sided enclosure with rounded angles: the northern angle is missing, flanking a 15 m gap on the west side, probably the result of intrusive later terracing. There is also a slot for an external palisade 3-8 m in front of the ditch on the south-east, south, and west sides. This was a narrow trench about 0.5 m wide and more than 0.3 m deep, filled with leafy humus; when prodded by the discoverers, the surveyors, deeper soft patches were found, indicative of post holes. Other similar slots outside the cross-ridge defences had previously been tentatively identified by the writer from Nicholas' account (1817 I:336) of an external palisade and will be discussed later. Excavation is needed in several sectors to confirm these features, and to establish details of the constructions.

The summit enclosure was in effect a ring-ditch pa although the bank and ditch are not continuous and may have been unfinished. They were omitted for 22 m on the south side above the very steep hillside above the Patonga stream, although the ditch was dug at a reduced size around the western angle. The earthworks begin again where the slopes ease (Fig. 4, section X-B) and are continuous round the south angle and along the south-east side. Although the bank is present, only a short length of ditch, 10 m, exists on the east side, ending just short of a gap in the scarp, a possible entrance to the pa. Beyond this a shallow depression indicates that the ditch continued along the east side and has probably been filled in (Fig. 4. Section A-X). Excavation is needed here to test this hypothesis and to look for a causeway related to the gap. The ditch can be traced for 10 m beyond the north-east angle but then fades out above the steep terraced slopes at the head of the re-entrant valley to the north. It reappears as a short length (14 m) where the fortifications cross the ridge and the enclosure became more easily approached. It is highly probable that there was originally an entrance here flanked by the ditch end and in line with that through the cross-ridge defences (︽ on plan Fig. 3, and discussion to follow). As previously noticed, there is a 15 m gap in the defences on the west side, probably due to the insertion of later small-scale terracing, which would have destroyed the other side of the conjectured entrance (see Fig. 5). The space, however, is covered by the external palisade at the crest of steep slopes. Again excavation is needed here to check whether the ditch was originally continuous and if not, to establish the position of the ends, and to test for post holes at the possible entrance.

There are five small gaps in the perimeter scarp, two on the south side 25.5 m apart, and one on each of the south-east, east and north sides; they are all narrow cuts, 0.75 to 1 m wide with eroded surfaces worn down into the natural soil (Figs. 3,6). Two of the five open into the ditch, the other three are continuations of the elaborate system of gullies (sunk paths or drains?) dividing the interior (discussed below). Some gaps could have functioned as sally-ports, enabling the defenders to reach quickly parts of the external palisade that were under attack or to retire to new positions behind the scarp. All could have provided exits for surface water draining from the interior after heavy rain.

The cross-ridge defences (Figs. 3,4)

North of the summit enclosure, the ridge narrows, trending north-west and flanked by the steep slopes to the Patonga stream and to the head of the re-entrant; it is only 15 m wide between the scarps at its narrowest point, where the defences are situated. The conspicuous features are a broad ditch 4-5 m wide, and a pronounced internal scarp crowned by a bank 1.5 m high (Section D-X, Fig. 4). These defences cross the ridge and bend inwards on either side; on the west, they terminate on the steep slopes, on the east at what appears to be an entrance, 2 m wide between inturned scarps (Fig. 3). This passage-way lies below the ridge top and has not been previously identified as an entrance. Kelly accepted instead a narrow pathway that cuts diagonally across the scarp and descends into a broad, shallow portion of the ditch where the edges are ill-defined (Marsden 1932:98). The path has been much worn down and deepened by erosion; it is doubtful if it is a pre-European feature, though its origin is hard to account for. Excavation here is needed to test for a causeway in the ditch floor and to examine the new alternative passage-way for postholes.

Outside the transverse defences, there are many small rectangular enclosures on the ridge top and on the steep slopes at the head of the re-entrant (Fig. 3). Those on the slopes (8) are terraced, those on the ridge top (12) are defined by shallow gullies and minor scarps. If, as seems likely, they enclosed houses and cultivation patches, these would have hindered the defence, blocking the field of view and preventing easy access to the probable entrance. It can be deduced that these are later constructions, at a time when the pa was out of action. Originally there was a system of palisades on the ridge top which now can be discerned with difficulty in the undergrowth. The palisade slots are narrower and deeper than the gullies defining the enclosures; there are three possible parallel lines of slots across the ridge and one lateral above the steep western slopes. The first line is 15 m away from the outer edge of the ditch, the second 25 m away: both are short lengths that also form a side of an enclosure. The third line is 33 m away and has a small triangular enclosure abutting on to it. There is no reason why the three lines should be contemporary; once more, excavation is needed to test their character and the relationship of lines 1 and 2 with the enclosures.

The eastern defences (Figs. 3,4)

On the east side of the summit enclosure, the ground slopes steeply and steadily in thick scrub with a fall of approximately 1 in 4 below the filled-in ditch; it has been terraced and sub-divided in an irregular fashion, indicative of occupation (Fig. 3). Where the slope eased, a strong line of transverse defence was constructed across the shoulder of the hill. It consisted of a ditch 2.5 m wide, an internal scarp and an external palisade slot 5-7 m in front of the outer edge of the ditch (Section A-X, Fig. 4). There was an entrance near the south-eastern end approached by a causeway across the ditch but screened by the palisade (see Fig. 3); attackers would have been trapped in the passage between the ditch and the palisade before they could turn to reach the gate. There was perhaps a postern or sally-port south of the main gate where the defensive scarp is sharply angled and inturned, leaving a narrow gap between it and the end of another palisade slot coming downhill from beside the inner enclosure. The position is obscured by undergrowth and needs clearing and testing by excavation. Other possible defensive features are four shallow rectilinear depressions close behind the outer palisade slot (Fig. 3), these could be the remains of rifle pits. Both the ditch and associated palisade ended on the steep side of the northern re-entrant but the defensive scarp turned westward and continued for about 30 m along the side of the re-entrant, presumably to prevent any infiltration from the easier slopes to the east.

The defensive sequence (Figs. 5,6)

The archaeological evidence for the construction of the defences will now be summarised and then discussed in the light of the observations made by Nicholas and Marsden in 1815. The primary construction must be the summit enclosure, a ring-ditch pa, with a defensive scarp and intermittent bank and an entrance partly destroyed on the north side and another likely on the east (Fig. 5). In all probability the enclosure was screened by palisades along the west and south facing slopes. The strong transverse defences designed to block the easy line of approach to the pa from the north-west along the flat crest of the ridge are presumably contemporary or perhaps a slightly later addition. The entrance was in alignment with that conjectured for the summit enclosure. In the second phase of construction, most of the east-facing ditch of the summit enclosure was filled in and replaced by a stronger and transverse defence 20 m downhill (Fig. 6). This included an external palisade and a causeway entrance near the south-east end, supplemented by a possible postern. At this time there was an external palisade enclosing three sides of the summit enclosure as well as its eastern extension. It can be inferred that the main approach was now from the south-east, round the shoulder of the hill from the Waimate plateau rather than from the north-west along the ridge. The narrow gaps in the scarp of the summit enclosure seem likely to be secondary since they weakened the defence. However once the pa was enclosed by an external palisade these may have functioned as exits used in conjunction with the gullies (sunk paths) in the interior. The gap on the east side would have provided convenient access from the new outer enclosure, utilising a sunk path uphill across the intervening terraces and proceeding along the line of the filled-in ditch (Fig. 3).

During the last phase of occupation the original defences were partly put out of action: the northern entrance to the summit enclosure was replaced by three small scarped plots, and the way to the outer entrance through the cross-ridge defences was similarly blocked. There was considerable overspill along the ridge and at the head of the re-entrant, mainly in the shape of terraced cultivation plots but also some probable house sites with rua pits. These would have prevented the cross-ridge defences from functioning effectively. It is obvious that the inhabitants no longer feared an attack from the ridge and that the ceremonial approach to the pa was by way of the east entrance.

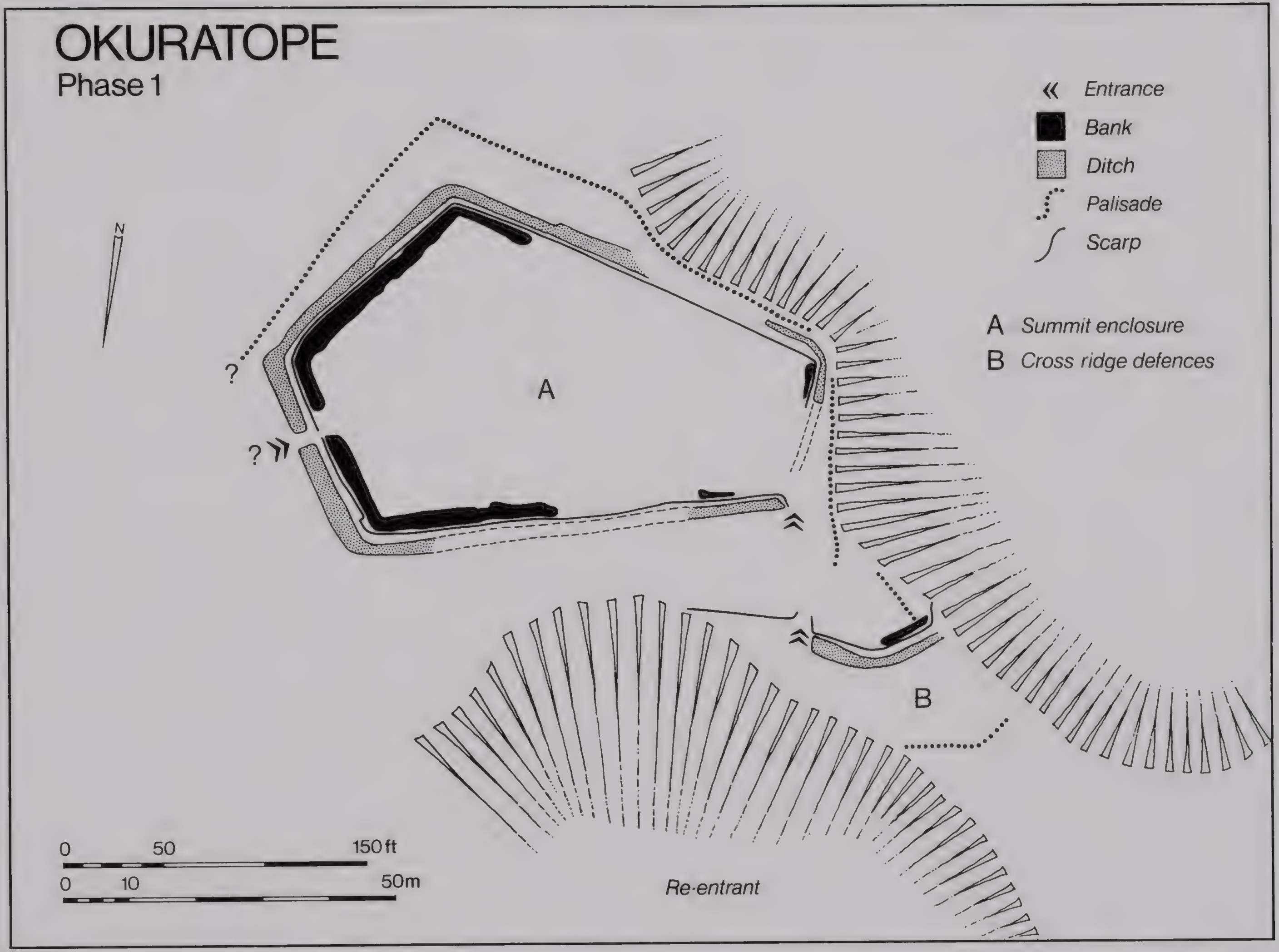


Fig. 5. Diagram plan, Okuratope, phase 1. Drawn by M. Rouillard.

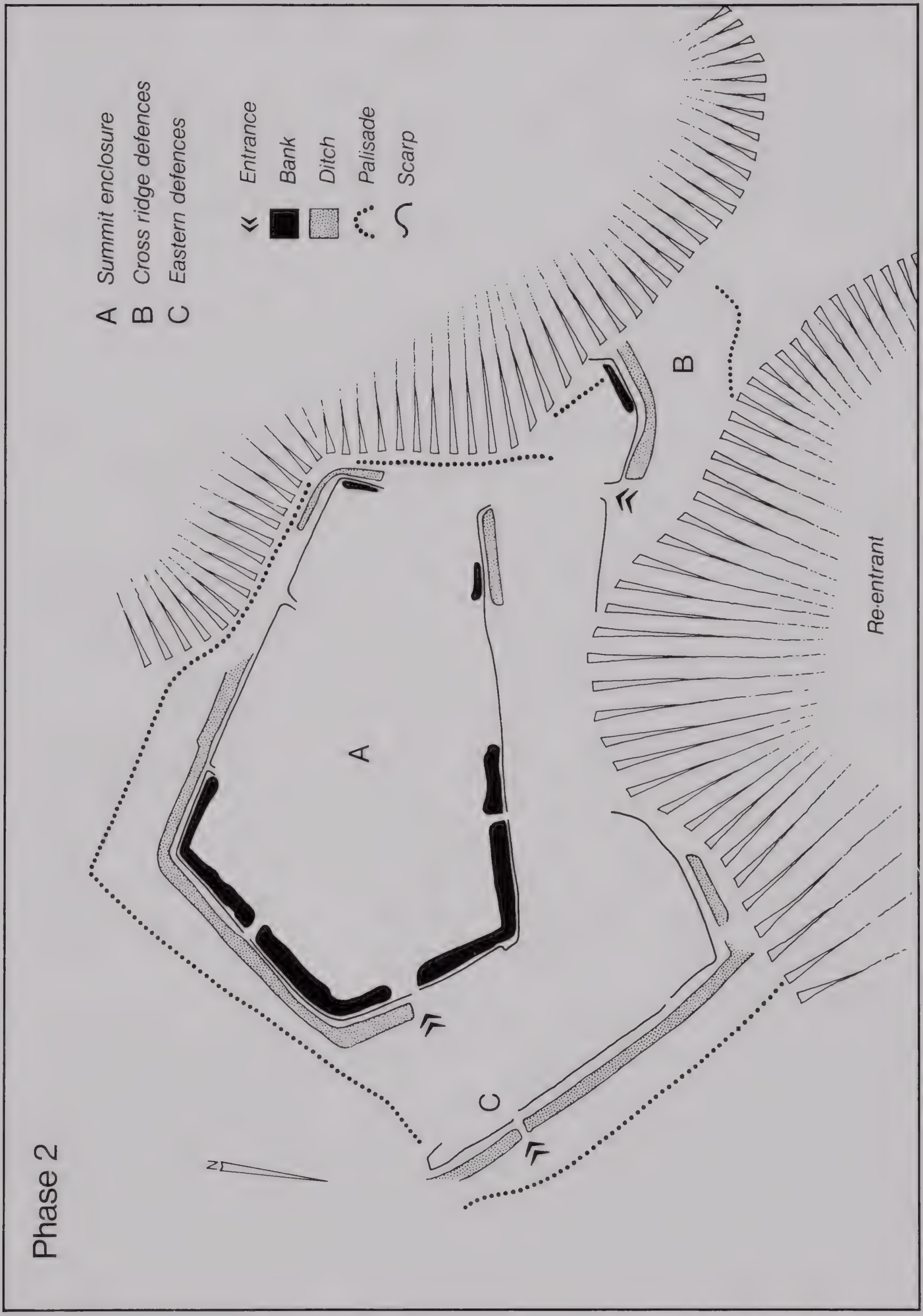


Fig. 6. Diagram plan, Okuratope, phase 2. Drawn by Mr Rouillard.

It now remains to compare the pa defences as described with those seen by Marsden and Nicholas in 1815. Nicholas' description is detailed and explicit (1817 I:336-7); he was impressed by the skill and ingenuity displayed in their construction. "The first bulwark that encompassed the town" was a strong palisading of close-set heavy posts, some 20 ft [6 m] high. It had a backing of strong wickerwork "to obstruct the lances of their enemies" as well as port-holes for musket fire. There was an entrance through this palisade which was 5 ft [1.5 m] high and 2 ft [0.6 m] wide, decorated externally with carved savage-looking heads. There was then a space of about 30 ft [9 m] to "a moat" 9 ft [2.7 m] wide backed by a steep mound on which there was another line of palisades. "The moat defended an entrance formed by another postern. Between this and the last approach to the town there was an intermediate space of 80 ft [24 m] at the extremity of which the hill was cut down perpendicularly about 15 ft [4.5 m] (i.e. scarped); and on its summit rose another row of palisading that encircled the hippah and completed the works".

The encircling scarp is clearly that defending the summit enclosure, although Nicholas makes no mention of the associated ditch and bank or the whereabouts of the entrance. It is difficult to determine whether these are casual omissions or whether these incomplete perimeter earthworks were dug after his visit; if so, there will have been three phases of construction. The 'moat' backed by a steep mound 80 ft away and defending an entrance is clearly applicable to the cross-ridge defences. Nicholas' use of the term 'moat', instead of the usual ditch or trench, is apt; according to the Oxford English dictionary a moat is "a wide flat bottomed ditch, usually holding water", which is consistent with the appearance of this earthwork. Nicholas does not say that it actually held water when he saw it in mid-summer but he obviously thought it could. He was wrong because the situation across the ridge makes this impossible, since any water would drain away eastwards down the slope. No mention is made of any terracing or buildings in the space between the summit scarp and the moat; this supports the contention that these were insertions of later date. The palisade described as being 30 ft (*ca.* 9 m) in front of the moat is difficult to identify. Of the three possible slots now discovered across the ridge the innermost is about that distance from the earthwork but it is obscured by being incorporated in a later enclosure; it would need to be longer to provide an effective barrier. The outermost slot is defensively well sited but it is too far away to fit with Nicholas' estimated measurements: presumably it is a later construction.

Another problem is that Nicholas (1817 I:341) refers to a western gate when leaving the pa the next morning for a visit to Lake Omapere. No details are given except that the hill outside was "nearly perpendicular". This well describes the westeren slopes to the Pakonga stream, which would have to be negotiated when travelling in the direction of Omapere, 5 km to the south-west (Figs. 1,2). The exit from the pa would have been by what is here termed the northern gate and through the gap in the palisades at the edge of the scarp (Fig. 5). Since one side of the gate is conjectural, the opening may have been angled to face west and so conform with Nicholas' location.

Marsden's account of Okuratope differs from that of Nicholas. He describes the pa as being enclosed by "three very deep trenches cut round the sides of the hill, one above another, and each trench fenced round with whole or split trees from 12 to 20ft [3.6-6 m] high" (Marsden 1932: 97-9). There is no triple ditch system at

Okuratope, though there were, according to Nicholas, three lines of palisades on the ridge, one external, one on the bank of the 'moat' and one on the summit scarp, with which Marsden may have been confused. He confirms that the entrance to the pa was by a narrow gate where Hongi showed him a small secret corner where he could be concealed and fire upon the enemy (op. cit.: 99). This presumably was beside the northern entrance to the summit enclosure and has disappeared in the later alterations.

THE INTERIOR OF THE PA (Fig. 3)

On the hilltop the ground within the innermost defences was fully taken up by some 35-40 rectilinear enclosures. The layout was very irregular and no logical plan can be discerned. The compounds are defined by shallow gullies or occasionally by low scarps. The sizes and shapes vary: the largest are oblong, 15 x 7 m approximately, the smallest are squarish, 4 x 5 m, but there is no uniformity. Two examples have an angular recess, whilst a detached group of three (south of X, Fig. 3), which are out of alignment with their neighbours, look like a later insertion. In twelve of the compounds there are ruas, circular underground store pits, cut in the hard clay soil, and measuring 1-2 m in diameter at the base. The sides are undercut beneath a small opening at the top, which has usually partly collapsed, and the pit is now filled with a natural accumulation of soil and leafy humus. One rua about 1 m deep now holds water. In most cases there is only one rua in a compound situated at the side, but occasionally there are two and in one compound there are three. In some places the ruas appear to have been dug through the dividing gullies and so may be of later date.

The interpretation of this maze of sub-divisions is fraught with difficulties which can only be solved by the total excavation of select examples, and the location of the houses and other timber structures they must have contained. It it also needed to decide whether the dividing gullies functioned as drains at the edges of the compounds, in the same way as the trench boundaries that define some cultivation plots (Leach 1984:50), or whether they were well-worn sunk paths for the inhabitants to move about the interior of the pa without trespassing on another property. It is proable that they will prove to be a mixture of both. The wider gullies are suggestive of thoroughfares and in three instances they lead to gaps in the perimeter scarp which are possible entrances. Narrow lanes or pathways with stiles to enter the house enclosures were a feature of Rangihoua pa, described by Nicholas (1817 I:174-5, Spencer 1983 :93-4) and may be analogous. A few compounds with a similar trenched outline can be seen at Mawe pa, Lake Omapere (Fig. 1) so these are a local feature (Best 1975 :335 and fig. 92; and personal observation). The friable nature of the clay loam soils on the Okuratope ridge top suggests that the need for drainage was not acute.

Some assistance with interpretation can be gained from the Nicholas and Marsden accounts. Both confirm that the central pa was densely inhabited; Nicholas (1817 I:338) describes it as a town with more than 100 houses and stores, Marsden (1932 :97) as a village of about 200 houses. Both state that the individual houses were fenced round by a strong barrier of stakes but make no mention of drains or pathways. Marsden adds that the roofs were thatched with eaves projecting 3 ft (0.9m) over the sides to carry off the water and keep the buildings dry. Both writers comment on the number of well-built storehouses. Nicholas (1817 I:340) describes one that had a high door and a verandah around it beneath the 3 ft (0.9 m) eaves and was surrounded by a paling of stakes about 10 ft (3 m) away. This sounds like a *pataka* of the type drawn by Augustus Earle at Pakanae on the Hokianga (Murray-Oliver 1968: Pl. 49), though Nicholas does not say whether it was raised. (Marsden 1932 :99) mentions another building that was 30 ft (9 m) long and 20 ft (6 m) wide that was used as an arms store as well as for provisions. Hongi had shown the visitors some spears that were 23ft (7 m) long (Nicholas 1817 I:340-1) so the size is credible; such a storehouse would have occupied one of the large enclosures. A central arms store adjoining the chief's house was recorded at Paeroa pa, Bay of Islands, when visited by du Fresne in 1772 (Fox 1976: Fig. 40).

One feature impressed both writers, the seat or throne of Kaingaroa, with another beside it for his mother (Nicholas 1817 I:339). This was in the centre of the town at the highest point, "commanding a most extensive view of the surrounding countryside in all directions" (Marsden 1932 :99). The position can now be identified from the plan (Fig. 3) as being somewhere in the irregularly shaped compound south-east of X at *ca.* 190 m ASL. This is large enough to act as a place of assembly, in effect as a *marae,* when the chief sat there "either for business or pleasure just as occasions required his consulting with his people" as Marsden observed. The throne was described as a platform or stage, 20 ft (6 m) by 3 ft (0.9 m), raised 6 ft (1.8 m) above the ground on a single post with decorative carving, with a step to get up, which also acted as a footstool (Nicholas 1817 I:339). This sounds a rather unsteady construction if the measurements are correct and presumably there were additional supports which were not thought worth mentioning. Comparison may be made with a *whata* depicted by Earle which has a substantial anthropomorphic pillar as a main support and a slender pole at the rear (Murray-Oliver 1968 : Pls 7, 52). The chief's lady at Okuratope had her bench seat close by, with her provisions kept in "a little hut about 4 ft [1.2 m] from the ground, 3 ft [0.9 m] long and 2 ft [0.6 m] wide," with an image beside its small door. This must have been a *whata* raised on a pole of the familiar type recorded by Earle in the Bay of Islands (Murray-Oliver 1968 : Pls. 19, 26 and 48), which contained the tapu food for the chief and his relatives. The structures described at Okuratope would require substantial post holes but archaeologically they might be difficult to locate or to distinguish from other constructions in the compound. Lastly Nicholas (1817 I:354) commented on the provision of a latrine to which he was taken after a large meal. It was outside the defensive scarp of the town and through an opening in the palisades, and consisted of a branch of a tree laid horizontally which projected over a cut in the hillside 15ft (4.5 m) deep. On the west side of the pa, overhanging the steep slopes, there are two small terraced platforms that may indicate the place, since they are relatively inacessible and have no obvious defensive use.

THE POPULATION

The population of Okuratope was thought by Nicholas (1817 I:338) to be "from 200 to 300 souls", although he admitted they saw very few of the inhabitants because most of them had gone down to the coast to procure a stock of fish for the winter. He based his estimate on the number of houses and stores, numbering more than one hundred. It has been argued elsewhere (Fox 1983 :7) that a Maori household occupying a terrace in a pa consisted on average of six adults. If the 37 compounds in the summit enclosure at Okuratope are accepted as the equivalent of terraces on the slopes, this would produce a population of 222 adults, very similar to Nicholas' figure. There is archaeological evidence that the population increased after Marsden's and Nicholas' visit. As already noticed, the zones between the defences, previously open according to Nicholas, were terraced and sub-divided presumably for living quarters, except for the space behind the earthworks needed for mustering the defendants in case of an attack. As the plan (Fig. 3) shows there are ten terraced plots on the east slopes and at least eight on the north-west; these would add about another hundred persons. Since there are also well-defined plots outside the defences on all sides of the pa, the final total may have been greater; it is difficult to distinguish occupation sites from terraced cultivation plots in this area apart from the few with rua pits. Further evidence for the rapid growth of population in the region comes from a later visit by Marsden (1932 :470-74). In March 1830, he again visited Waimate at the request of chief Rewa, the former chief Kaingaroa having died, with the object of finding "a piece of ground for a missionary station and for the purposes of agriculture". The district was then thought to contain about a thousand people "in a number of different establishments belonging to different chiefs" and "within a compass of six miles [9.6 km] round it, there were about a thousand more". These numbers may be exaggerated but the fact that there was a large population in the vicinity, as well as fertile soils, determined the founding of the Waimate mission station in April 1830, *ca.* 2 km north-east of Okuratope.

CHRONOLOGY

There is only one fixed point in the history of Okuratope, namely the descriptions by Marsden and Nicholas of how they saw it in 1815. There is no suggestion that it was then a recent construction or acquisition of the Ngapuhi chiefs, Kaingaroa and his brother Hongi. It can be inferred that it had been inhabited for at least a generation previously (20-25 years) and therefore probably dates from the late 18th century. It is possible that an earlier date could be established by excavation and radiocarbon analysis, together with an examination of local oral tradition. From the archaeological point of view, the plan is compatible with a late date, since the defences include a ring-ditch and bank, admittedly incomplete, around the main enclosure, as well as strong outer transverse defences on the easiest line of approach (Fig. 5). It is generally accepted that the ring-ditch is a late development, though it is not common in the Bay of Islands: Ngahuha pa, Smith's Road, built at the junction of two volcanic craters is another outstanding example, but is undated.

It is interesting to see how a prehistoric pa of conventional plan was adapted for musket warfare in the early 19th century, as practised by its first Maori exponent, the chief Hongi. Nicholas' account records that 'portholes' (loop holes) for firing, were cut in the palisades. The substantial bank behind the 'moat' across the ridge may have been built to protect the defenders from a return of fire. Hongi also showed Marsden a corner concealed beside the entrance from which he could direct his fire. A possible line of rifle pits was incorporated in the later eastern defences behind the palisade (Fig. 6).

It is not clear when Okuratope was abandoned; the extended pa and external settlements were presumably still in existence, and functioning as a tribal centre in

1830 when Marsden returned to Waimate to negotiate with chief Rewa for land for his new mission station. After the Treaty of Waitangi and the Hone Heke wars of 1845-46 the pa could have served no useful purpose and settlement is likely to have shifted to more accessible places on the nearby plateau.

SUMMARY

The recent survey of Okuratope by Leatherby and Morgan (Figs. 3, 4) has added some new dimensions to the pa; it is a much larger and more complicated site than Kelly's previous plan suggested. The probable lines of external palisades have been identified for the first time and the position of several entrances have been located. Within the main enclosure, the individual living quarters have been defined, some 35-40 compounds outlined by trench boundaries, enabling a rough assessment of the population to be made. A probable place of assembly, a *marae,* has been identified near the highest point. A study of the defences indicates two phases of construction (Figs. 5, 6) with an extension on the east side, which reflects a change in the principal line of approach and potential attack. The development of terracing between the zones of defence as well as outside the pa are evidence for a growth of population during the second phase. There is no archaeological means of dating the construction, pending excavation, but on historical grounds a flourishing occupation is attested in the early 19th century and a late 18th century origin is probable. The terminal date suggested is after A.D. 1830-1840.

Acknowledgements. I am indebted to the Bay of Islands Maritime and Historic Park Board for permission to survey Okuratope and for supplying information about the acquisition of the Historic Reserve. John Coster of the Auckland district office of Lands and Survey kindly sent a brief account of the local soils and rock formations. The survey was financed from a grant by the Auckland University Research Committee to Dr Anne Salmond of the Anthropology Department who generously made the necessary funds available. I am very grateful for her assistance and continuing interest in the project: it was she who first introduced me to Marsden and Nicholas in her lectures in 1973. I would like to thank Dr Douglas Sutton, Anthropology Department, for the loan of surveying equipment from the Pouerua excavations, an alidade and other equipment from the Anthropology Department and a theodolite from the Engineering Department. I also thank other friends, Aidan Challis, Janet Davidson and Nigel Prickett, who have answered long-distance questions and have commented on the text. I owe a special debt of gratitude to Janet Leatherby and Peter Morgan for the trouble they have taken with the survey, and for the contributions their fieldwork made to the final plan. We have had useful discussions about the difficulties and possible interpretations of the site. I am well aware that my conclusions are tentative and need to be tested by future excavations.

The map and diagrams (Figs. 1, 5, 6) are the work of M. Rouillard, draughtsman in the History and Archaeology Department at Exeter University, England, by kind permission of Professor M. Todd.

REFERENCES

BEST, E.
1975 The Pa Maori. *Dominion Mus. Bull.* 6. (Second edition).

FOX, A.
1976 *Prehistoric Maori Fortifications.* Auckland, Longman Paul.
1983 Pa and people in New Zealand. *N.Z. J. Archaeol.* 5:5-18.

LEACH, H.
1984 *A Thousand Years of Gardening in New Zealand.* Wellington, Reed.

MARSDEN, S.
1932 *Letters and Journals of Samuel Marsden, 1765-1838.* J.R. Elder (ed.) Dunedin, Coulls, Somerville Wilkie.

MURRAY-OLIVER, A.
1968 *Augustus Earle in New Zealand.* Christchurch. Whitcombe and Tombs.

NICHOLAS, J.L.
1817 *Narrative of a Voyage to New Zealand* (2 vols). London, James Black.

SPENCER, J.R.H.
1983 Rangihoua pa and Oihi Mission Station, Purerua Peninsula, Bay of Islands. A lot of Spadework to be Done. *N.Z. Archaeol. Ass. Monogr.* 14:77-110.

SUTTON, D.
1982 Proposed archaeological research in the inland Bay of Islands. *N.Z. Archaeol. Ass. Newsl.* 25:183-190.

THE TWIN-LOBED PENDANT, AN ARCHAIC ARTEFACT FROM THE NELSON DISTRICT

NIGEL PRICKETT

AUCKLAND INSTITUTE AND MUSEUM

Abstract. Ten twin-lobed pendants of the New Zealand archaic phase of Maori culture are presented and their raw material, formal variation and distribution described. Raw material and distribution point to an origin in the Nelson district. The suspension of twin-lobed pendants, their symbolism and the significance of their distribution are discussed.

In 1925 the *Journal of the Polynesian Society* published in successive numbers editorial notes on two examples of “a peculiar stone artifact of unknown use”. The first reference was to one which had been found recently during drain digging operations near Waverley (Anon. 1925a:273). The second example had been found forty years previously near the mouth of the Rangitikei River (Anon. 1925b:385). The two items are now in the Wanganui and Auckland Museums respectively. The following year a third example was brought to the attention of members of the Polynesian Society by the Director of the Wanganui Museum, Mr R.G. Firth (1926:175-176). It had been found in 1914 at Karehana Bay, Plimmerton, on Porirua Harbour, and was acquired by the Wanganui Museum in the 1920s (Fig. 1).

In *The Moa-Hunter Period of Maori Culture,* Duff (1950:106-110) discussed the form under the name “hybrid reel”, describing it as a “partly divided sphere”. He identified the artefacts as amulets or pendants, to be worn on the breast, suspended around the neck. Duff noted the three North Island examples which had been introduced in the *Journal of the Polynesian Society,* and drew attention to three more: from Whangamoa and Whakapuaka, near Nelson, and from the Wairau Bar site near Blenheim. All three are held in the Canterbury Museum. A seventh example was published in 1953 by Skinner & Phillipps (1953:177, 191). It is said to come from Fisherman Island on the west side of Tasman Bay, Nelson, and is now in the Nelson Museum.

In 1974 Skinner ascribed the name “human testicles” to the form (Skinner 1974:58, 59), and introduced yet another example which he incorrectly located to Kawakawa, Northland. It was, in fact, found in the 1950s by Mrs Mavis Brambley, at the important archaic site near Manukau South Head, Auckland (N46-47/17). It was the presentation of this item to the Auckland Museum in 1981, as part of the Bill and Mavis Brambley Collection, which prompted the present research.

Rec. Auckland Inst. Mus. 22: 17-29 18 December 1985

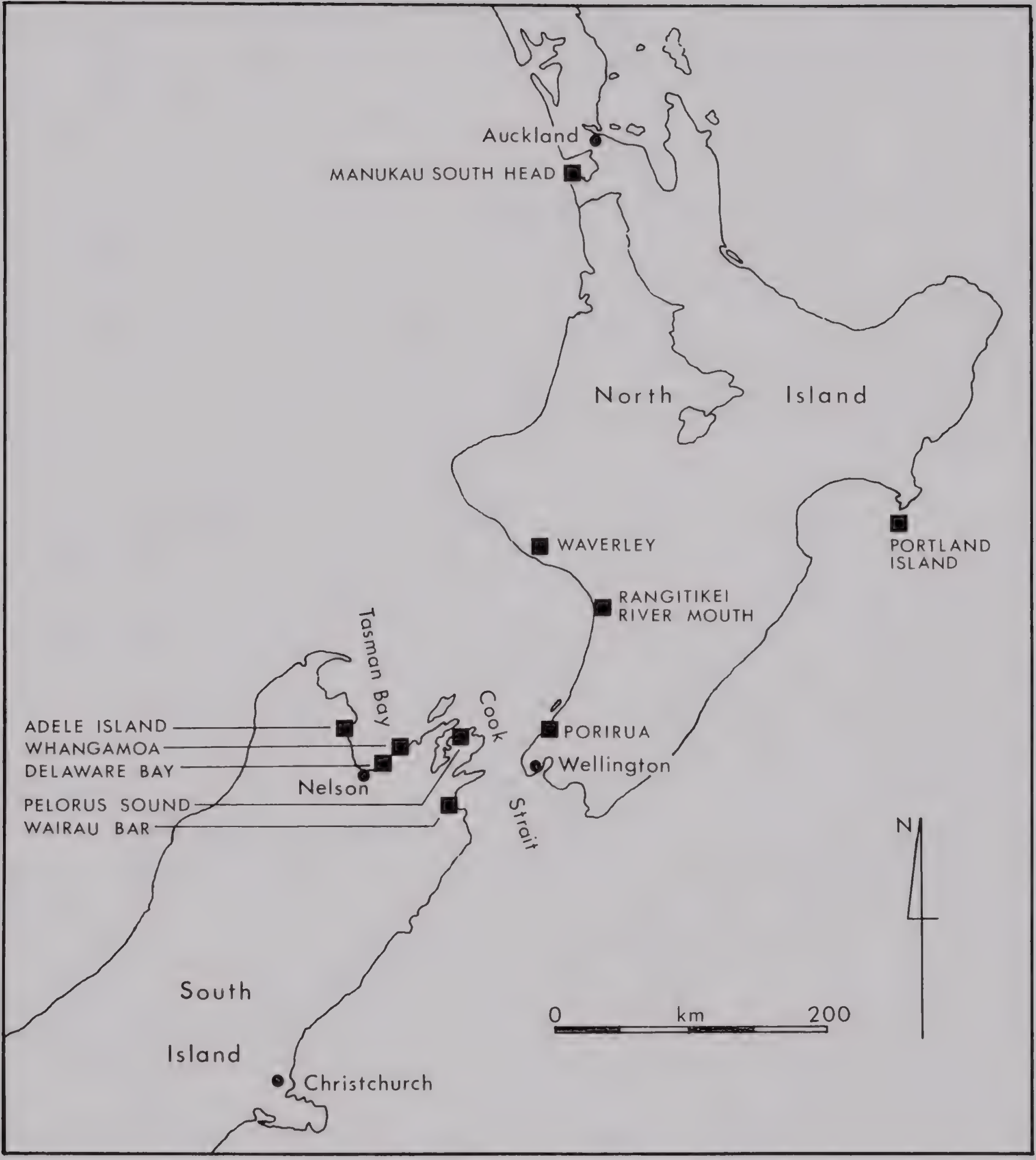


Fig. 1. Map showing distribution of finds.

Two further examples of the ‘partly divided sphere’ can now be introduced. One was found on the shore of Pelorus Sound in 1956-57 and is now in the Nelson Museum; the other is said to have been found on Portland Island, Hawkes Bay, and is held in the Hawke’s Bay Art Gallery and Museum, Napier. The known total therefore is ten, all held in public museums. There may be other examples in private hands, of which information would be gratefully received by the writer. The purpose of the present report is to bring together what is known of the provenance and physical characteristics of the known examples, to examine their origin and distribution, and to consider their symbolism and relationship with other pendant forms.

Before entering the detailed description of examples of this artefact, reference is needed to the name. Duff's (1950:106) "hybrid reel" is essentially interpretative, as is Skinner's (1974:58) "human testicles". Much better is "partly divided sphere" (Duff 1950:106), in that the name is purely descriptive, leaving interpretation open. Some examples, however, are far from spherical, and for this reason I put forward here the name 'twin-lobed pendant' as being more accurately descriptive, and at the same time describing the use or function on which there is general agreement. In this name I follow Jolly and Law who first used it in their 1977-78 typescript catalogue of the Brambley Collection.

THE PENDANTS

The group of ten pendants includes seven complete, or near complete, examples and three represented by one lobe or a part thereof. Presentation here is by institutions in which they are held; catalogue numbers are in parentheses.

Auckland Institute and Museum

Manukau South Head (AR7000), Fig. 2

The Manukau South Head pendant was found by Mrs M. Brambley at the important archaic site, N46-47/17, Manukau South Head. The only previously published reference and illustration is in Skinner (1974:58-59), where the location is incorrect.

The raw material is deep green/black serpentine with some pale green inclusions. At 44.8 g the Manukau South Head pendant is much the lightest of the group, less than half the weight of any other. The measurements (width, 41 mm; height, 30 mm; depth, 27.5 mm) show it to be not spherical, but having a distinctly greater length than height or depth.

Rangitikei River Mouth (17319), Fig. 3

This pendant was found by Mr E.C. Rockel in the 1890s near the mouth of the Rangitikei River. The first publication of the item was in 1925 (Anon. 1925b:385). It came into the Auckland Museum in 1932.

The raw material is dark green/black serpentine. The Rangitikei River pendant is one that can reasonably be described as a 'divided sphere'. The measurements of 64 mm width, 59 mm height and 56.5 mm depth show how nearly spherical it is. The weight is 246 g. Figures 2 and 3, showing the two Auckland Museum examples, illustrate nicely two characteristic pendant shapes, the spherical and the slightly elongate, and two treatments of the central notch, slightly flared or with parallel sides.

Canterbury Museum

Delaware Bay (E146.271), Fig. 4

The pendant previously described as having come from Whakapuaka (Duff 1950:109) is more accurately located to Delaware Bay. It was ploughed up by Mr

T.A. Fuller on the terrace which backs the lagoon behind the bay, overlooking the Tuarawhati sandspit. It came into Canterbury Museum in 1946, and was first published by Duff (1950:109, Pl.14).

The Delaware Bay pendant is important as the only example yet found which is apparently made from material other than serpentine. Duff (1950:109) describes it as serpentine, but the dark grey hammerdressed appearance of the stone is quite unlike the serpentine of all other twin-lobed pendants. Beverley McCulloch of the Canterbury Museum suggests it is basalt. The pendant falls into the small group of these artefacts which are spherical, or nearly so, as the close conformity of width (74 mm), height (70 mm) and depth (61 mm) shows. At 429.1 g the Delaware Bay pendant is much the heaviest of the group. It was broken in two at the neck when ploughed up and has since been glued together.

Wairau Bar (1459), Fig. 5

Only one lobe was recovered of the Wairau Bar pendant. The finder, Jim Eyles, writes (17 December 1984) that it, "...was found on the surface after cultivation of the paddock in the main camp area and was not associated with the burial location." It was recovered in the 1940s and was first described by Duff (1950:110) in his report on the Wairau site.

The raw material is dark green/black serpentine. The piece does not include the neck so that the 52.5 g weight must be more than doubled for the total, which was perhaps 120 g. The height (43 mm) and depth (37 mm) can be obtained from the recovered piece. The length may be estimated at 55 mm. Duff's (1950:110) statement that the pendant is slightly flattened at the 'back' is arguable (see Fig. 5).

Whangamoa (E120.6.1), Fig. 6

The Whangamoa pendant was found by Mr H. Thomas at the mouth of the Whangamoa River, some 10 km north-east of Delaware Bay. It retains the sand-blasted appearance of beach finds. It was first published by Duff (1950:107-109, Pl.14), and subsequently by Skinner (1974:58-59). In Mead (1984:180) it is illustrated in the catalogue where it is incorrectly labelled as the Whakapuaka (that is, Delaware Bay) example.

This pendant is one of the lightest in the group at 106.4 g. It measures 53 mm in width, 46 mm in height and 29 mm in depth. Viewed from one side (Fig. 6) it has a close similarity to the Manukau South Head item (see Fig. 2). The other side, however, in contrast to all other twin-lobed pendants, is markedly flattened (Fig. 6). It is from the flat side of this pendant that Duff (1950:107) drew the conclusion that these artefacts were designed to be worn against the breast as a necklace unit or pendant.

For cultural reasons, these images have been removed.
Please contact Auckland Museum for more information.

Figs. 2-6. Twin-lobed pendants. 2. Manukau South head. 3. Rangitikei River Mouth. 4. Delaware Bay. 5. Wairau Bar fragment; view of cleft with broken neck at top. 6. Whangamoa; view from above (left) and front.

Hawke's Bay Art Gallery and Museum

Portland Island? (85,101), Fig. 7

The fragmentary remains of a pendant came into the Hawke's Bay Art Gallery and Museum with the Field Collection in 1984. Mr Field understood that his uncle found the item on Portland Island off Mahia Peninsula in the 1930s, but the possibility that it came from the Nelson district, from which a considerable part of the collection derives, was not ruled out.

The fragment of one lobe that has come to us has itself been broken in two and subsequently glued together again. The fragment weighs 94.5 g which is indicative of a total weight of *ca.* 350 g. The depth can be measured to 53 mm, and the width and height estimated at *ca.* 75 mm and *ca.* 70 mm respectively. The pendant was probably of fairly spherical form. The raw material is unique, being pale green serpentine with black inclusions to give a mottled appearance.

Nelson Provincial Museum

Adele Island (E320.72), Fig. 8

Half of a twin-lobed pendant was found *ca.* 1932 on Adele Island at the western side of Tasman Bay. The finder was Mr L.L. McNamara, who was in company with the collector Mr G. Soper. The pendant was first published by Skinner & Phillipps (1953:177 and 191). Skinner & Phillipps, and Duff (1956:108), locate the item to Fisherman Island, which is *ca.* 1 km south of Adele Island; I follow the museum catalogue entry in giving Adele Island as the location.

What remains of this item is one lobe and the greater part of the neck to the second lobe. The weight is 70 g which gives an original total weight of *ca.* 135 g. The height of the lobe is 45 mm and the depth, 35.8 mm. The width of the pendant may be estimated at *ca.* 50 mm. There is interesting evidence of re-use. A hole has been drilled through the broken neck to allow use as a pendant with the surface of the single curved lobe facing outwards. The curved surface itself is now decorated with incised designs, mostly tiny single spirals, with the single strongest element a concentric design reminiscent of the human mouth of some styles of Maori wood carving.

Pelorus Sound (E2.66), Fig. 9

This pendant was found in 1956-57 by Mr Ross Webber at the side of a creek behind Moki Bay, Pelorus Sound (map reference S11 (2nd ed.) 312627). The finder presented it to the Nelson Museum in 1965. Moki Bay is at the seaward end of Pelorus Sound, an area where the many small sites at the rear of bays and beaches are marked by flakes of metasomatised argillite indicating close links with the argillite (and serpentine) sources to the west.

The raw material is of mottled green serpentine, somewhat different from the usual dark green/black material. It is also a harder material than usual, which perhaps accounts for the comparatively poor finish. The weight is in excess of 100 g (a small

For cultural reasons, these images have been removed.
Please contact Auckland Museum for more information.

Figs. 7-11. Twin-lobed pendants. 7. Portland Island (?) fragment. 8. Adele Island fragment (from Skinner & Phillipps 1953:191). 9. Pelorus Sound. 10. Porirua; with sketch showing double row of notches. 11. Waverley; showing arrangement of grooves at neck.

fragment is broken off one lobe). The width is 52.5 mm, height 36 mm and depth 34 mm. The rough finish includes small grooves which remain where the central notch has been cut out.

Wanganui Regional Museum

Porirua (51.310), Fig. 10

Usually referred to as having come from Porirua, this pendant was found in 1914 by a contractor, Mr MacMahon, while excavating house foundations at Karehana Bay, Plimmerton, at the north side of Porirua Harbour (Firth 1926:175). It subsequently came into the Wanganui Museum and was first published by the director of the museum, Mr R.G. Firth, in 1926. In the first reference the find spot is described as "... a very old settlement at Motuhara, on Porirua Harbour."

The most unique aspect of this pendant is the two rows of 42 notches divided by a shallow sawn groove, which extends over the narrow curved top (Fig. 10). Overall, the shape of the pendant is also unusual: it is narrow (22 mm depth), almost twice as wide (67.5 mm) as it is high (35.5 mm) and is almost flat along the bottom. It has been broken into two large and several small pieces, now glued together. In addition one side has been severely battered, with many pieces still missing. The original pendant thus weighed rather more than the present 108 g. The battering it has received may date from the pendant's discovery; or it may date from an earlier time when the item was deliberately broken by its owners in a manner reminiscent of the ritual breakage of hei tiki. The battering has exposed the interior which is black serpentine with numerous opaque white veins.

Waverley (51.309), Fig. 11

The editorial note and illustration of this item in the *Journal of the Polynesian Society* in 1925 was the first published reference to the artefact form (Anon. 1925a:273). The location is given as Waverley: the museum catalogue adds the information, "found by Fred Parkinson drain digging". There are photographs in the original reference and line drawings in Skinner (1974:58).

The Waverley pendant weighs 225.5 g. It is made of dark green/black serpentine with veins of pale green colouration. The width is 56 mm, height 47 mm and depth 46 mm. It is similar in size and shape to the Rangitikei River mouth example. What makes it unique is the well-finished pattern of grooves at the top of the neck which extend in a V-shape from each side of the top of the central cleft, resulting in a diamond pattern. End on, the shape of the item is markedly triangular, with the pendant sitting securely on a flat bottom.

DISCUSSION

Nine of the group of ten twin-lobed pendants are made of serpentine (or 'talc') from the Nelson region. The raw material occurs in association with a variety of metasomatised rocks in the Ultramafic Belt which extends through hilly or mountainous country from D'Urville Island in the north 200 km southward. It is available both *in situ* and as water-rolled material in riverbeds. Except in two cases the serpentine is a comparatively soft dark green/black material, often with pale green veins or, in the case of the Porirua pendant, opaque white veins. The Pelorus Sound item is of a hard serpentine of lighter green colour, and the Portland Island example is made of pale green, coarse, material with black inclusions. The Delaware Bay pendant may be made of basalt, which occurs in meta-basalt form in the Nelson Ultramafic Belt.

Twin-lobed pendants take a variety of forms. Some are nearly spherical: the Rangitikei River Mouth and Delaware Bay pendants provide the best examples. The Portland Island pendant, and possibly the Adele Island and Wairau Bar examples, may also have been close to spherical if indications from the surviving fragments are true to the whole. The Waverley pendant appears round from the front, but from the top is distinctly flattened at the ends and sides (see Fig. 11), and from the end view takes on a rounded triangular shape. The Manukau South Head example takes the elongate form further than the Waverley pendant. The Pelorus Sound pendant is close to the Manukau example in form, as the measurements and Figs. 2 and 9 show. From the front, the Whangamoa pendant is also closely similar to the Manukau South Head item; from the end or above, however, it is very clearly different having a depth of only 29 mm as a result of one almost flat side (Fig. 6). The remaining, Porirua, pendant takes even further this flat sided form, in addition to its other unique formal aspects (see Fig. 10). In this case the pendant is only 22 mm deep, with both sides quite flat. As well, the width is almost twice the height which makes it unusual indeed. Only three items have decorative elements additional to the basic form: the pendant from Waverley has a diamond shaped arrangement of grooves at the top of the neck, that from Porirua has a double row of notches separated by a groove which extends over the narrow 'top' of the pendant, and that from Adele Island has incised surface decoration.

The central cleft in almost all cases is widest at the mouth of the opening and narrower towards the neck. The clefts are the result of cutting by attrition 'saws' made of an abrasive stone material – probably sandstone. The parallel sided cleft evident in the Rangitikei River Mouth pendant presents a contrast to all others. It was cut probably by a similar technique, in this case making use of a thin flat 'saw' with parallel sides.

Lacking any perforation, the twin-lobed pendant must have been lashed to its suspension cord. Throughout the Pacific the manufacture of suspension cords for necklace or pendant units is itself a craft: the suspension is an important and decorative part of the total artefact. Suspension cords typically comprise much more than a simple twist or cord. They may include a fibre core, an enclosing decorative cord or braid, as well as the line by which the necklace units are actually suspended (see for example Te Rangi Hiroa 1944:113). The line which holds the necklace units may be enclosed within the body of the main cord, emerging to thread or tie the necklace units, or may simply tie each unit independently to the main suspension cord. Alternatively, the suspension may be made up of multiple light individual cords to which the pendant unit or units are attached, with a single strong cord continuing around the back of the neck for tying. An example in the Auckland Museum is from Aitutaki in the Cook Islands: a black-lipped pearl oyster (*Pinctada margaritifera*) pendant is lashed through four perforations along the upper margin to 32 light two-ply rolled cords (Te Rangi Hiroa 1944:122). The well known *lei palaoa* ornament of Hawaii also used multiple strands, in this case of human hair.

Within the tradition of decorative suspension elements to which pendant units are strongly lashed it is easy to see how the New Zealand twin-lobed pendant was suspended. The main decorative suspension element, whether of single or multiple strands, was laid over the top of the pendant unit, which was then lashed to it by fine thread passed repeatedly through the cleft. The notches on top of the Waverley pendant may give clues as to the form of decorative lashing employed (see Fig. 11). It can be argued that the diamond shaped design marks the boundary of a lashing device which held the pendant in position (with line passed many times through the cleft for strength and rigidity) to properly present to the world the two lobes and the cleft between them.

Further to this it may be suggested that it is unlikely other early necklace units were simply threaded for suspension. Sharks teeth, chevroned pendants, stone discs and other forms which are transversely drilled for suspension, would undoubtedly have been lashed to a main suspension cord or cords, following the Pacific-wide custom. Imitation whale tooth pendants in bone or stone also, although they are drilled parallel to their suspension cord, most likely were strung or lashed beneath the main decorative suspension cord. The widely used pictures of reconstructed 'whale tooth' necklaces simply strung on a twisted line (see for example Duff 1950:Pl.17) may not be correct.

Duff's previously held view that the twin-lobed pendant is an early form was proved right by the finding of the Wairau Bar example (Duff 1950:110). Archaeological confirmation comes with the Manukau South Head find which is associated with other typically archaic material in the most important early assemblage of the Auckland region. Additional internal evidence adds weight to the dating of these artefacts. The notching on the Porirua example is a characteristically early feature. Nelson raw material is itself suggestive of a date when access to, and distribution of, other Nelson stone materials was at its height, that is, in the early period.

The Nelson origin of the twin-lobed pendant is clearly indicated by the distribution of the ten reported finds (see Fig. 1). Three (possibly four) came from the district, with another two from the nearby southern shore of Cook Strait. Three more pendants come from the south-west coast of the North Island, which is highly accessible by sea from Nelson. Manukau South Head and Portland Island are further away. It can be argued that the Manukau location is a northerly extension of the west coast North Island distribution. It is unfortunate, however, that the Portland Island location is open to question. If the location is correct then it is an interesting exception to the Cook Strait and west coast distribution; if, in fact, the item comes from Nelson, as is possible, then it adds to the strong focus of known finds from that region.

Twin-lobed pendants confirm the importance of the Nelson district as a source of stone material early in the occupation of New Zealand by Polynesian people. Metasomatised argillite from the district was the supreme raw material for adzes in the early period and is found at archaic sites throughout New Zealand. Serpentine occurs in association with metasomatised argillite: exploitation of the latter would have brought skilled stoneworkers into contact with the serpentine. The raw material was also used for the marvellous disc-shaped pendants and what Duff (1956:Pl. 19A) calls "aberrant 'whale-tooth' pendants", again artefacts of the early period. It is also notable that twin-lobed pendants are found only on the coast and usually at sites or localities of strongly archaic affinities. Thus Wairau Bar, Delaware Bay, Whangamoa and Manukau South Head are important early sites, while Pelorus Sound, Porirua and Waverley are all districts rich in early sites or finds.

The location of finds in the Cook Strait area and up the west coast of the North Island may indicate something more general about the distribution route of stone materials from the Nelson region. Metasomatised argillite is now so widely distributed throughout New Zealand in the form of adzes that a very considerable study would be needed before a pattern could be established, and then it is doubtful if it would be as simple as that afforded by the distribution of twin-lobed pendants illustrated here in Fig. 1. There are, in fact, good reasons for arguing that the west coast of the North Island afforded the easiest route north from the Nelson area. It avoided a canoe passage south-east through Cook Strait and north along the stormy Wairarapa coast, and the land route along the coast, to Taranaki at least, was comparatively uninterrupted by peninsulas and rocky coasts characteristic of the east coast. There are, nonetheless, other possible reasons for the distribution. It may be, for example, that there were strong tribal links between people of the south-west coast of the North Island and the northern South Island, and that serpentine pendants were among items exchanged as tangible tokens of these links.

In regard to the age of the twin-lobed pendant it is interesting to consider the history of the Adele Island item. Skinner & Phillipps (1953:177, 191) note and illustrate the incised design over the curved outer surface of the remaining lobe (see Fig. 8). They do not discuss the hole drilled through the broken neck to allow its re-use as a pendant of fundamentally different aspect. It is clear that the hole and the incised design are related. Almost certainly the broken pendant has been re-used; the designs serve the dual purpose of decoration and, more importantly, establishing the new owner's relationship with the pendant and denying or nullifying any potentially dangerous earlier relationship. Such an item, when found, would easily be recognised as being man-made and could not be treated lightly. The new owner must say who he is and give notice of ownership. The suggestion of Skinner & Phillipps (1953:177) that the motifs are unusual in the context of Maori design seems unjustified. The decoration takes the form of characteristic late Maori motifs: single spirals, fishhook shapes, and a concentric design similar to the human mouth of some regional styles of wood carving.

In referrring to the twin-lobed pendant as "human testicles" Skinner (1974:58) follows Duff's (1950:110) interpretation of the symbolism of the form. Duff (1950:111) writes: "I would suggest that these hybrid reels represent a local memory of the 'phallic' ornaments of whale ivory which were elaborated in recent times in the Cook Islands, at Atiu, where a single large amulet was worn as a breast pendant, and at Mangaia where smaller ones served as units of composite necklaces." The present writer would add that the smaller examples are also represented in the collection of Auckland Museum among material from Rurutu in the Austral group. The Austral and Cook group examples date from the late eighteenth or early nineteenth century (see Te Rangi Hiroa 1944:108-116).

If the twin-lobed pendant does indeed represent human testicles then this could be argued to indicate descent and status — long important to Polynesians. The suggestion that it may be linked to the Austral and Cook Islands testicular form, however, leaves some important questions unanswered. The most obvious is that of chronology: if there is an historical relationship between the ivory units of the central Pacific and the New Zealand pendant, then it would be interesting to have evidence of ancestral forms. Assuming the twin-lobed pendant to be early in the New Zealand sequence, then similar or ancestral forms might be expected from early levels in eastern Polynesian sites. Exactly what form these might take is open to question. An interpretation which links historically a symbolic and minimal early form from the geographic periphery of east Polynesia to a highly representational form dating from perhaps five or six centuries later and found in the central eastern Polynesian homeland region, clearly implies major gaps in our knowledge.

The relationship of the twin-lobed pendant to other New Zealand forms is also of interest; Duff (1950:106) gave the name "hybrid reel" to the form and states the case for a formal relationship with the well known and widely distributed archaic reel unit made of ivory, bone or stone. The link is through a single example of a cleft reel made of serpentine and held in the National Museum (see Duff 1950:Pl. 14). If we consider the suggested symbolism of the twin-lobed pendant, and regard it merely as a variant of the reel as Duff suggests, then there is a clear implication that the reel form too is a testicular symbol. An argument against this is that reel and twin-lobed units appear together in late central Pacific necklaces; thus they would appear, in these cases at least, to project different messages or ideas, whatever these are. Nonetheless, it is not impossible that in New Zealand the reel has a similar symbolism to the twin-lobed pendant. There is, however, only one cleft reel to link the two forms: nor is interpretation of the twin-lobed form as human testicles itself above argument.

A further consideration concerns the relationship of archaic pendants or necklace units and later Maori forms. Similar notions concerning such matters as descent, mana, role and status are widespread throughout Polynesia and it is unlikely these fundamental social concepts changed much in New Zealand. It is the formal symbolisms or representations of such concepts in art and ornament which tend to change and not the underlying concepts themselves. An argument can be made that pendant forms in New Zealand, both early and late, relate something of importance concerning the wearer. It might be expected therefore that the range of messages would be more or less the same for the early and late ranges of artefacts. There has been little enough study of the meaning and significance of late Maori pendants of jade and other material. Some understanding of the late material might give us clues as to the importance and symbolism of the archaic range, of which the twin-lobed pendant is such a distinctive part.

Acknowledgements. I would like to thank museum people and private individuals who have provided information and illustrations of the various pendants; in particular David Butts (Hawke's Bay Art Gallery and Museum), Brian Henderson (Wanganui Regional Museum), Beverley McCulloch (Canterbury Museum), Maurice Watson (Nelson Provincial Museum), Mavis Brambley, Jim Eyles and Ross Webber. Caroline Phillips drew the map, Alan Leatherby photographed the Auckland Museum pieces and Joan Lawrence drew the Porirua and Portland Island finds.

REFERENCES

ANON.
1925a A peculiar stone artifact of unknown use. *J. Polynes. Soc.* 34:273.
1925b Stone artifact of unknown use. *J. Polynes. Soc.* 34:385.

DUFF, R. S.
1950 *The Moa-Hunter Period of Maori Culture.* Wellington, Department of Internal Affairs.
1956 *The Moa-Hunter Period of Maori Culture* (second edition). Wellington, Government Printer.

FIRTH, R. G.
1926 Stone artifacts of unknown use. *J. Polynes. Soc.* 35:175-176.

MEAD, S. M. (Ed.)
1984 *Te Maori.* Auckland, Heinemann.

SKINNER, H. D.
1974 *Comparatively Speaking.* Dunedin, University of Otago Press.

SKINNER, H. D., and W. J. PHILLIPPS
1953 Necklaces, pendants, and amulets from the Chatham Islands and New Zealand. *J. Polynes. Soc.* 62:169-195.

TE RANGI HIROA
1944 Arts and crafts of the Cook Islands. *Bernice P. Bishop Museum Bull.* 179.

JAVANESE ANGKLUNG IN THE AUCKLAND INSTITUTE AND MUSEUM

ANGELA R. ANNABELL

AUCKLAND

Abstract. Three specimens of the musical instrument, *angklung,* from Java, gifted to the Museum by Capt. G.A. Humphreys-Davies in 1930, are examined with reference to the organology of the *angklung*, its historical and social context, and to its pitch and tonality. Pitch measurements and tonal sequence in relation to traditional Javanese tone sequences are tabled. Note is made of the present-day use in Indonesia of a Westernized form of the *angklung.*

The bamboo rattle-chime, *angklung,* as represented by three specimens in the Auckland Museum, is a folk instrument of ancient origin.

The classical Javanese orchestra (*gamelan*) includes a variety of wood and metal chime-idiophones, but the *angklung* is traditionally associated with ensembles used in village rites and festivities rather than with more sophisticated court orchestras. Although there is evidence of its dispersal throughout Java, as well as in the islands of Madura, Bali, Sumatra and Borneo, the instrument is primarily associated with West Java, in particular with the Sundanese mountain districts, where its highest concentration is found (Kunst 1973, 1:361). That a comparatively recent work based on fives years' study of *gamelan* instruments in Central Java (Lindsay 1979) makes no mention of the *angklung* serves to confirm its inherent status as a folk artefact.

The three *angklung* in the Auckland Museum (Fig.1) were gifted in 1930 by Captain G.A. Humphreys-Davies who later was Honorary Curator of the Oriental Collections in the Museum. The Auckland Museum accession book records (Acc.No. 133/30 of 14.IV.30) "Three musical instruments called Anklong [sic.], used by the Sundanese of Central Java". These instruments are typical two-tubed bamboo *angklung* with measurements as given in Table 1.

Organological aspects

The specimens in the Auckland Museum accord with most general descriptions of the instrument as constructed of two or three bamboo tubes of graduated lengths, tuned in octaves, and suspended vertically in a rectangular bamboo frame. The upper portion of each tube is cut to form a tongue, the lower end is closed and has two short extending strips which fit loosely into individual slots cut into the transverse tubular base (Fig.1). When the frame is shaken, the tubes slide back and forth in their slots sounding their characteristic notes by striking the rim of their grooves (Grove 1980, 1:427, 9:208; Kunst 1973, 1:361; Jenkins 1970:34; Wellesz 1957, 1: 167).

Rec. Auckland Inst. Mus. 22: 31-40 18 December 1985

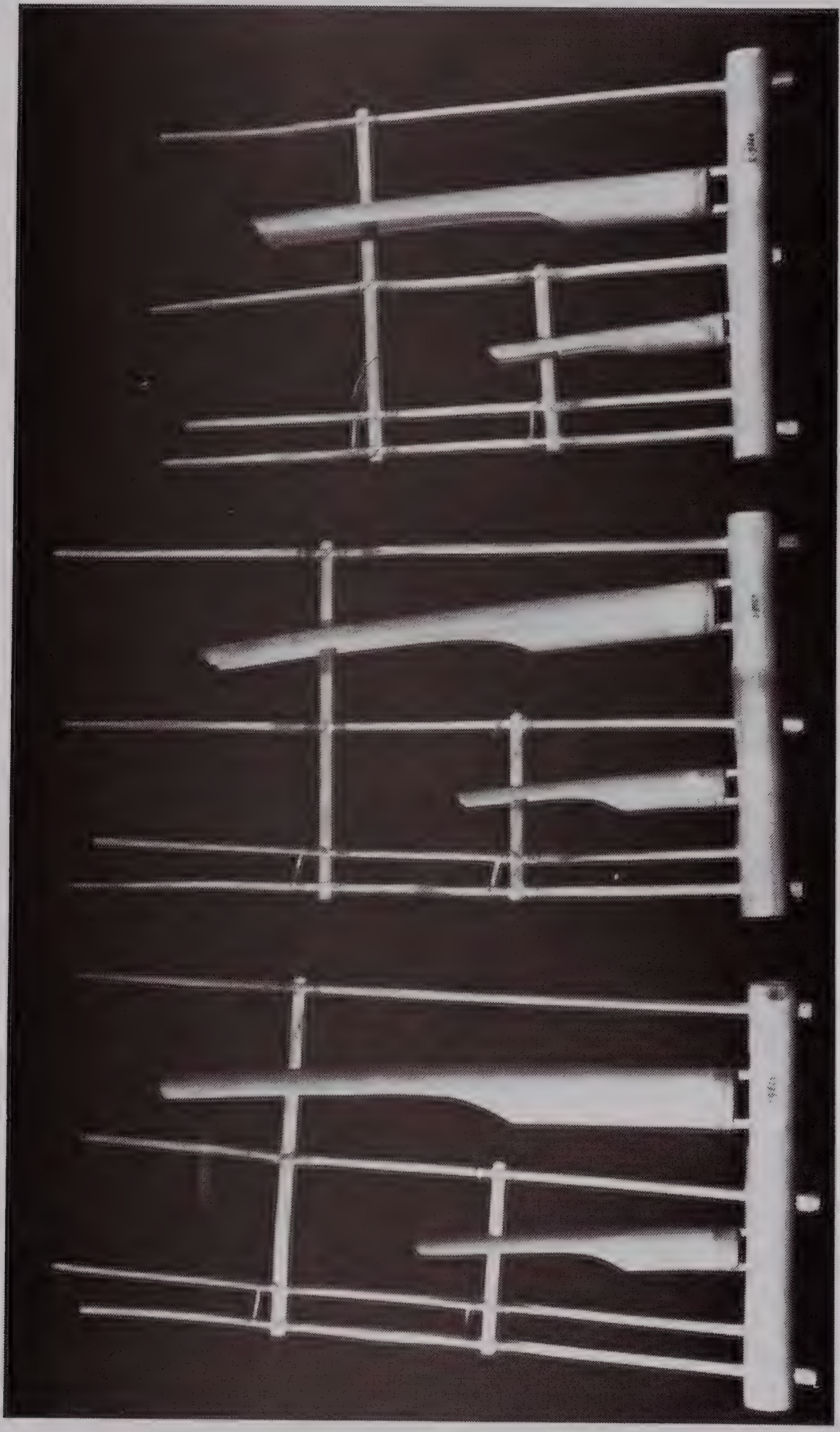


Fig. 1. *Angklung* in the Auckland Institute and Museum (Nos. 4796.1-3). Left. 4796.2. Middle. 4796.1. Right. 4796.3.

Table 1. Measurements of *angklung* in the Auckland Museum (Nos. 4796.1-3).

*Angklung**	4796.2 cm	4796.1 cm	4796.3 cm
Outside frame rods	54.0	54.5 54.0	47.0
Horizontal base	29.5	29.0	29.0
Large tube, full length	44.0	39.5	36.0
from lowest cut edge	18.0	15.5	13.0
inside diameter	3.0	2.8	2.5
Small tube, full length	25.0	21.5	19.0
from lowest cut edge	10.0	9.5	8.5
inside diameter	2.0	1.8	1.5

* Measurements of the 3 instruments are given in the same order as they appear in Fig.1.

Kunst (1973,1:361) states that the air column in the tubular part of the mobile bamboo segments of the *angklung* produces, when blown, the same tone pitch as the entire segment (tubular part plus tongue) when beaten or shaken. The distinctive shape of the *angklung* tubes (Fig.1) is the result of cutting to form a tongue and resonator balanced in pitch as stated. To ascertain pitch of the tubular part or resonator the tube is blown into; and, although the *angklung* is essentially an idiophonic instrument, the passage of air in the tubular column is also associated in popular Javanese belief with the instrument's origins. In earlier times, Raffles (1817, 1: 472) wrote, "The Javans say the first music of which they have an idea was produced by the accidental admission of the air into a *bámbu* tube, which was left hanging on a tree, and that the *ángklung* was the first improvement upon this Eolian music."

An ancient Javanese agricultural method also suggests a constructional analogy with the *angklung*. Carefully-cut bamboo tubes were arranged on pivots so that when filled with water from irrigation channels above they toppled over, and upon regaining an upright position hit a stone, causing a ringing tone to be emitted at regular intervals. From this it evolved that whole series of tubes were often erected superflously with deliberate attention to pitch and timing (Kunst 1973, 1:196). The affinity of this bamboo water clatterer or *taluktak* with chime-idiophones such as the *angklung* is readily apparent.

Standard references generally describe the *angklung* as two- or three-tubed. The outside frame rods of the two larger two-tubed instruments in Auckland measure 54-54.5 cm (Table 1) compared with the measurement of 81 cm given for a two-tubed instrument in the Horniman Museum, London (Jenkins 1970, pl.4, No.29). A four-tubed instrument is mentioned by McPhee (1966: 32,235) as found in Bali. There is evidence also of an early form in the Sundanese district of West Java having "five or more tubes... cut at the end after the manner of the barrels of an organ" (Raffles 1817, 1:472). The description is illustrated in an engraving showing, among such household implements as a loom and spinning wheel, an *angklung* of five tubes (ibid., pl.opp.168). The estimated length of the tubes as ranging from "about twenty to eight inches [50.8-20.3 cm]" (ibid:472) is compatible with full length tube-measurements of the Auckland instruments, which range from 44.0 to 19.0 cm (Table 1).

Photographs of later Javanese *angklung* show the usual instruments with only two or three tubes, but often suggest a larger, more primitive, format (Kunst 1973,2: 440,Ill.121; 444,Ill.136; 448,Ill.151; Winitasasmita & Budiaman 1978: 12,Ill.1) than that of the instruments under discussion. They are held by seated, standing, or walking players and sometimes have their frame-tips decorated with ribbons or feathers. In one instance *angklung* reach from almost ground level to the full height, and higher, of the walking musicians (Winitasasmita & Budiaman 1978: 13,Ill.2).

Traditional Javanese *angklung* are usually combined in sets of nine or fourteen instruments of graduated size and pitch, and are played either held in the hand, in which case a single player can handle only two instruments at most, or suspended in scale sequence onto a long bamboo yoke (*kakancho*), when two or three players will suffice (Kunst 1973, 1:362, 2: 448,Ill.150). Sources vary as to the number of instruments per set: Grove (1980, 9:209), "four or more", Jenkins (1970: 34), "seven or eight". That the *angklung* is traditionally employed in this way, however, accounts both for disparities in size of isolated specimens, and for the overall gradation in tube-lengths from small to large of the three Auckland instruments, which may be part of an original larger set.

In Java, according to McPhee (1966), the *angklung* is usually shaken back and forth in performance, the tubes knocking against both ends of their slots to produce a tremolo tone, as distinct from the Balinese method of using a series of single, or quickly repeated double shakes. The hollow, almost metallic sound produced is not unmusical and generally has a strong appeal to the Western ear.

The quality of bamboo used, its thickness and diameter, and even the season in which it is cut (Winitasasmita & Budiaman 1978: 68) are important considerations in the manufacture of the *angklung*. Some idea of the exacting process of cutting, paring, and testing also involved is given by McPhee (1966: 235, footnote[1]) from observation in Bali.

> A *pandé krawang* from the Karangasem village of Tiyingan made me a set of *angklungs* by the following method. Each tube was cut to its approximate length, after which the tongue was cut. The tube itself was then tuned by cutting down, the *pandé* blowing into it from time to time and listening to ascertain the pitch. As a model for tuning, a *gangsa* [metal keyed instrument] from the ensemble for which the *angklungs* were intended was used. When the right pitch had been reached, the tongue was then cut down until, when tapped against the cement floor of my house, it gave the same tone as when the tube itself was blown into. The *pandé* explained "The tongue is the key (*don*) and the tube its resonator (*bụmbung*). Key and tube must correspond in tone as in other instruments."

It should be noted that the normal folk *angklung* of Java, like those in the Auckland Museum, is an octave *angklung* sounding one tone amplified at the octave. A rarer type occurring in Central Java and Borneo, although similar in appearance to the octave *angklung* is often made of a spotted bamboo, and its invariably three tubes are tuned not in octaves but in three different tones to form a chord (Kunst 1973, 1: 363).

Historical and social context

McPhee (1947: 101) remarks that the *angklung* was used in Indonesia "long before the coming of the Hindus". The Hindu immigrations which began in Java about the first century A.D. inaugurated a period of Indian influence which extended into the sixteenth century. Writing of the older stock of natives known as *kalang* (wild devils) and called by the first Hindu invaders *rásaka,* Campbell (1915, 1:8, 10-12) gives an account of primitive Javanese harvesting rites which incorporated the *angklung.*

> When the crop of wild millet was gathered, the elder decided when and where the horde should next move. Before departing they feasted and offered sacrifices in an open plain, attracting to the remains of their repast the bird called *úlung gága,* and the young men would shake a rude musical instrument ... called the *ángklung,* shouting and dancing to its accompaniment in a wild, ludicrous and aimless fashion, and becoming at last mad with its sounds ... In case of favourable omen [dependent on the antics of the bird] another feast was partaken of, which ended in violent exhibitions or demonstrations of joy, in which the *ángklung* played a prominent part. When all was ready for the journey, the oldest man of the horde with his wife and children either was placed upon an elephant or was carried in a rough litter, and began to move in the direction he had indicated; the rest moved on foot behind him. Preceding the horde were the young men and boys shaking the *ángklung* and shouting aloud, for the two-fold purpose of rendering the necessary homage to their chief and of frightening away the wild beasts which abounded all over the island in countless multitudes at that period.

Sir Stamford Raffles, Lieutenant Governor of Java from 1811 to 1816, recorded (T.S. Raffles 1817, 1:472) that a troop of from ten to fifty mountaineers, each with an *angklung,* and accompanied by one or two others with a small drum played with the open hand, always performed on occasions of festivity in the Sundanese districts. The upper parts of the instruments were generally decorated with common feathers, as were the performers themselves, who were described as "grotesque and wild". Raffles was so charmed, nonetheless, by the sound produced by the rattling of the bamboo tubes that he confessed to never having heard the *angklung* without pleasure. An ancient use of the *angklung* all over West Java as part of an ensemble accompanying masked dances (*topèng*) is also reported by Kunst (1973, 1:379).

Twentieth-century reports of the instrument include its use in the following ways:

(1) In an ensemble of four single-headed drums and several *angklung* to accompany rice harvesting activities in West Java. The dancing musicians accompany the rice carriers to the village and perform the ancient *dogdog lojor* dance (Grove 1980, 9: 212).

(2) In the *badut* folk orchestra of West Java consisting of nine *angklung,* one to four *dogdog* [single-headed drums], and a *tarompèt* [an oboe-like wind instrument], whose players perform burlesque dances while playing (Kunst 1973, 1:378, 2: 448,Ill.149).

(3) In the *bunchis* folk orchestra of West Java, whose players also perform simple dances, generally moving around in a circle (ibid,1:379).

(4) In the *ogèl* folk orchestra of West Java, which provides accompaniment to the performance of buffoons (ibid).

(5) In ranges of five or seven *angklung* suspended on a yoke, replacing traditional instruments in both West and East Javanese *gamelan* (ibid: 363).
(6) Among the South Banten Badui people of West Java on the occasion of the *kawalu* feast, as a signal at the close of work on sacred arable land (ibid).
(7) As a signalling instrument for guardsmen in a *kampong* (village), West Java (ibid).
(8) For bridal music in an ensemble of three *angklung,* Central Java (ibid: 364).
(9) As an accompaniment with other instruments to a peculiar form of dancing-play called *strandul* in South Surakarta, Central Java (ibid: 287).
(10) In a *reyog* (folk drama) *gamelan* in Ponorogo, East Java (Grove 1980, 9:204).
(11) In a *gamelan angklung,* for cremation rites and temple anniversaries in the Karangasem district of East Bali (McPhee 1947:111).

Pitch and tonality

When the *angklung* is shaken, the note emitted by its largest tube is sounded an octave above by the tube next in size, and at an octave higher again by the smallest tube if there are three tubes. It is thus basically a single-tone instrument. In performance, players often build up between them melodic figurations as a background to a main melody (Kunst 1973, 1:362); hence the employment of sets of *angklung* with individual instruments variously pitched to conform with a particular tone sequence.

Owing to the extremely rapid decay in sound produced by the impact of wood against wood, (bamboo against bamboo), it was necessary in the case of the present instruments to employ an electronically-tuned instrument as an intermediary measuring device to record, on an oscillator, pitch measurement by vibration frequency. Table 2 gives the results with nearest frequencies for notes of the European scale in parentheses. For field measurement of folk instruments Roberts (1931:128) suggests a pitch-pipe which will give *a* = 435 vibrations. Measurements below are based on the present-day standard pitch measurement, 440 = a^1. Tone pitch as presently sounded is used in this study as a working basis but it should be borne in mind that some deviation from original tuning may have resulted from atmospheric changes and the instruments' long period of disuse. In Tables 2-4, c^1 and subsequent letters numbered ^{1} represent the ascending octave beginning on middle C of the pianoforte keyboard, c^2 begins the new octave.

Table 2. Pitch measurements of *angklung* in the Auckland Museum.

	Large tube	Small tube
4796.2	261.71 (261.6 = c^1)	523.31 (523.2 = c^2)
4796.1	310.5 (311.1 = $d\#^1$)	621.68 (622.2 = $d\#^2$)
4796.3	415.45 (415.3 = $g\#^1$)	830.75 (830.6 = $g\#^2$)

On the assumption that the three instruments in the Auckland Museum are component parts of one set (and their uniformity of construction supports this), the above results were then considered in the light of previously documented Javanese scales. Although the tone sequence of an *angklung* set may extend over more than two octaves, it is essentially pentatonic (Kunst 1973, 1:362). Three tone measurements out of a possible five were therefore available in the present instance. The measurements showed little conformity with the scale of an *angklung* set from Tasikmalaya, West Java (ibid). Two other comparisons, however, were feasible. Table 3 matches the results with a *pelog* scale of seven tones from which, for practical purposes, a selection of five tones may be made. The ratio of frequency numbers has been converted into cents according to the system devised by A.J. Ellis (1884), making possible interval-measurement within the framework of the European tempered scale (100 cents = 1 semitone). Nearest equivalent notes of the European scale are given below frequency numbers. It will be seen that where comparison is possible differences in terms of vibration frequencies and cent-intervals are only slight.

Table 3. Comparison of a West Javanese *gamelan pélog* scale (Kunst 1973, 2: 573, app. 61,30) with sound measurements obtained from *angklung* in the Auckland Museum.

	I	II	III	IV	V	VI	VII	I
Pélog Scale Vib.Freq.	262.5 c^1	283.5 c#^{1}	312 d#^{1}	368 f#^{1}	391 g^1	414 g#^{1}	458 a#^{1}	525 c^2
Cent-intervals		133	166	286	105	99	175	236
		299			488			
				778				
Auckland Museum *angklung* Vib.Freq.	261.71 c^1		310.5 d#^{1}			415.45 g#^{1}		
Cent-intervals		296			502			
				789				

Table 4 utilises a scale of another popular Sundanese instrument, the zither-like *kachapi*. A characteristic feature of this once frequently-heard scale is its close approximation to Western diatonic tonality (Kunst 1973, 1:358), hence its transcription by Kunst in Western staff notation (ibid: 396). Its transcription here in European letter notation and descending Javanese form is matched with the nearest equivalent notes of the Auckland measurements as indicated in Table 2, correspondingly flattened. Although necessarily incomplete, the matchings in Tables 3 and 4 illustrate the possibility of the selected scales, or of similar tone sequences, being used for an *angklung* set.

Table 4. Comparison of a Sundanese *mèlog kachapi* scale (Kunst 1973, 1:396) with sound measurements obtained from *anklung* in the Auckland Museum.

Mèlog scale	c^2	a_b^1	g	e_b^1	d_b^1	c^1
Auckland Museum *angklung*		a_b^1		e_b^1		c^1

Sponsorship of the angklung by the Indonesian government

The foregoing survey has dealt with the *angklung* in an historical and traditional context. Although the instruments in the Auckland Museum seem modest in format compared with some of the more primitive types, their acquisition by the Museum as early as 1930 suggests a rightful categorization within this traditional framework. It should be noted, however, that today "diatonic" *angklung* (*angklung* sets built and tuned in accordance with the Western scalic system) are authorized by the Indonesian government for use in schools, public clubs, and art groups. This development was initiated in the Kuningan Regency of West Java by a Western-educated high school teacher, Daeng Soetigna. After his aim of manufacturing a set of diatonic *angklung* was realised in 1938, the new musical instrument was introduced into local "boy scout" groups, thereafter quickly becoming a popular and integral part of the scout movement in West Java (Winitasasmita & Budiaman 1978: 13-14). Subsequently, decrees such as those by the Presidential Cabinet in 1966 (No.75), by the President of the Republic of Indonesia in 1966 and 1968 (Nos. 173 & 183), and by the Ministry of Education and Culture of the Republic of Indonesia (Keputusan Menteri Pendidikan Dan Kebudayaan Republik Indonesia, No. 082) in 1968 (ibid: 5), have firmly established the diatonic *angklung* as an instrument for use in musical education on an official and national basis. An outcome of this revivalist movement on behalf of one of Indonesia's most ancient musical instruments is the handbook *Angklung Petunjuk Praktis* [A Practical Guide to the *Angklung*] (Winitasasmita & Budiamin 1978), which gives full details of the background, specifications, playing, teaching, and care of the diatonic *angklung*.

Discussion

From Tables 2-4 it has been seen that the pitch- and interval-measurements of the Auckland Museum *angklung* partially conform with certain Javanese tone sequences. The possibility remains, however, that the three instruments are a self-contained set of three tones only. It is apparent also that they comprise a tonal framework which accords with Western diatonic tonality. In *Music in Java,* first published in 1933, Kunst writes of the acceptability of much Sundanese music to Western ears (1973, 1:358), a feature already illustrated in the *kachapi* scale of Table 4. Other scales are referred to as having become progressively more Westernized under the influence of European music and musical instruments (ibid: 394). In 1933, an official project was, in fact, launched in schools to raise native Sundanese vocal music from the decline brought about by this influence (ibid, footnote 3). As much of Kunst's original research was carried out in the 1920s it seems clear that the traditional music of the Sundanese mountain districts where the *angklung* is most common was under Western influence well prior to the Museum's 1930 accession-date for the instruments. The possibility is thus presented of Western-influenced *angklung* sets circulating in Java before the official introduction of the diatonic *angklung* in 1938, and of the Auckland instruments being part of such a set. That in appearance they more nearly resemble diatonic *angklung* held by West Javanese school children (Grove 1980,9: 209, Fig.24) than most depictions of the original folk instrument gives some feasibility to speculation in this direction. The three specimens have been accepted here, nonetheless, as traditional instruments and seen to conform generally with documented evidence of the traditional Javanese *angklung.*

Acknowledgements. Acknowledgement is made to the Museum Director, Mr. S. Park; to the Museum Ethnologist, Mr. D. Simmons, for advice and generous access to the instruments; and to members of the Ethnology Department for assistance. Thanks are due also to Mr. G. Maitland of the Museum Library for arranging photography and to the photographer Mr. P. Brennan. For technical expertise regarding sound measurements I am indebted to Mr. S. Beech. My thanks also to Mrs. R. Achmad, Department of Asian Languages and Literatures, University of Auckland, for her translation of *Angklung Petunjuk Praktis,* and to Miss B. Anscombe, Music Department Librarian at the University of Auckland, for supplying relevant literature.

REFERENCES

CAMPBELL, D. M.
1915 *Java: Past and Present. A description of the most beautiful country in the world, its ancient history, people, antiquities, and products.* 2 vols. London, Heinemann. 1236p.

ELLIS, A. J.
1884 Tonometrical observations on some existing non-harmonic musical scales. *Proc.R. Soc.* 37: 368-385.

GROVE, G. (Editor)
1980 *The New Grove Dictionary of Music and Musicians.* Vols.1 & 9. S. Sadie. (Ed.) London, Macmillan. 889p, 879p.

JENKINS, J. L.
1970 *Musical Instruments. Horniman Museum, London.* 2nd.ed. London, Inner London Education Authority. 104p.

KUNST, J.
1973 *Music in Java. Its history, its theory and its technique.* 3rd ed. 2 vols. The Hague, Martinus Nijhoff. 660p.

LINDSAY, J.
1979 *Javanese Gamelan.* Kuala Lumpur, Oxford Univ. Press. 59p.

McPHEE, C.
1947 *A House in Bali.* London, Victor Gollancz. 214p.
1966 *Music in Bali. A study in form and instrumental organization in Balinese orchestral music.* New Haven, Yale Univ. Press. 430p.

RAFFLES, T. S.
1817 *The History of Java.* 2 vols. London, Black, Parbury & Allen. 479p., 288p.

ROBERTS, H. H.
1931 Suggestions to field-workers in collecting folk music and data about instruments. *J. Polynes. Soc.* 40: 103-128.

WELLESZ, E. (Editor)
1957 The New Oxford History of Music. Vol.1 London, Oxford Univ. Press. 530p.

WINITASASMITA, H., and DRS. BUDIAMAN
1978 *Angklung Petunjuk Praktis.* Jakarta, PN Balai Pustaka. 68p.

NEW AND INTERESTING RECORDS OF ADVENTIVE PLANTS FROM THE AUCKLAND INSTITUTE AND MUSEUM HERBARIUM 11

E. B. BANGERTER

AUCKLAND INSTITUTE AND MUSEUM

Abstract. This eleventh list of additions to the Auckland Institute and Museum Herbarium (AK) by exchange or by presentation from collectors provides new records for some adventive species and further information on the distribution of others.

The main source of material for this eleventh list has been by exchange with Botany Division, D.S.I.R., Christchurch (CHR). Other material has been presented as vouchers for the records by the collectors. The list is shorter than those published previously owing to my absence for some time from the Museum Herbarium. My apologies are due to other collectors who may have donated specimens which I have not had time to include.

The nomenclature adopted in this paper follows that of the series of checklists published in the *New Zealand Journal of Botany* from 1978 onwards by members of the staff at Botany Division, D.S.I.R., Christchurch. This has entailed up-dating some specific names and using less familiar family names e.g. Brassicaceae for Cruciferae.

All specimens are cited by the AK number and by the collectors' numbers where these are provided. Unless otherwise stated the specimens may be regarded as the only material of the species possessed by the Herbarium and, where no previous literature is cited, as first records for New Zealand to the best of my knowledge at the time of writing.

FUMARIACEAE

Fumaria bastardii Boreau

Waitemata Co., Waitakere Range, Ruaotowhenua, Scenic Drive, 1981, J. Mackinder, AK 165764.

This is the second gathering of this fumitory to be incorporated in the AK Herbarium. As with the first, recorded by Bangerter (1984), it was too late to be included in Garnock-Jones (1979).

Rec. Auckland Inst. Mus. 22: 41-45 18 December 1985

BRASSICACEAE

Alliaria petiolata (Bieb.) Cavera & Grande

Ashburton Co., Ashburton River, under *Salix* and *Populus,* 1956, A.J. Healy 56/270, AK 167359, (dupl. ex CHR 89683).

The first record for garlic mustard, according to Garnock-Jones (1979), is by an anonymous author as long ago as 1893 but Ashburton is still the only known locality for it. The above gathering is stated to be the first collection of the species in New Zealand. A field note with the specimen says "a colony on river banks under trees".

Brassica tournefortii Gouan

Christchurch, growing at roadside on dunes behind North New Brighton Beach, 1983, A.E. Wright 6002, AK 164813, det. P.J. Garnock-Jones.

Reference to Garnock-Jones (1979) shows that Mediterranean mustard was first recorded by A.J. Healy in 1958 and that its distribution ranges from Auckland to Otago. Several authors have recorded the species since 1958 but the above gathering is the only representative in the AK Herbarium.

CARYOPHYLLACEAE

Silene vulgaris (Moench) Garke ssp. *maritima* (With.) A. & D. Love

Wellington, Karori West, Sunshine Avenue, rocky roadside bank, 1979, P.J. Garnock-Jones 1294, AK 160150, (dupl. ex CHR 363022).

The maritime form of the bladder campion was first recorded by Garnock-Jones (1981) based on a specimen collected in 1961 from New Plymouth by A.J. Healy.

LYTHRACEAE

Cuphea hyssopifolia HBK

Whangarei Co., Tutukaka, shell garden in front of Whangarei Deep Sea Anglers' clubroom, 1984, A.E. Wright 6331, AK 166062, det. W.R. Sykes.

The above specimen is noted as "the first naturalised record" and was too late to be included by Sykes (1982). Further information on the label states "Abundant seedlings and small flowering plants around two planted shrubs c.50cm tall; flowers cerise-purple".

PROTEACEAE

Telopea oreades F. Muell.

Taupo Co., Paurini Scenic Reserve, on western bank of the Tongariro River, 1983, R.O. Gardner 4021, AK 164117, det. W.R. Sykes 1984.

The above plant was discovered by Dr. Gardner too late to be recorded by Sykes (1982). The label informs us "one young plant on track edge; is setting fruit, parent plant at Tongariro Hatchery." A specimen of the parent plant (R.O. Gardner 4017) is also in the AK Herbarium but I have assumed that only the offspring was growing wild. The label tells us that "Tasmanian waratah is the local name".

GUTTIFERAE

Hypericum mutilum L.

Bay of Islands Co., Puketi State Forest, adjacent to an old logging road running from Pirau Ridge to Puketi East Road, 1984, P.J. Bellingham, AK 167607, det. R.O. Gardner.

The first specimen of this *Hypericum* to be incorporated in the AK Herbarium was recorded by Bangerter (1978) from Matamata. The above from further north is the second. It is said to be "adventive next to old road with *Paspalum dilatatum* and *Agrostis tenuis*". The known distribution of the species is given by Sykes (1982).

GROSSULARIACEAE

Ribes odoratum Wendl.

Maniototo Co., Ranfurly, wasteland, 1966, A.J. Healy 66/434, AK 163188, det. A.J. Healy, (dupl. ex CHR 152497).

Reference to Given (1984b) shows the first record for buffalow currant to be in Thomson (1875) where it was erroneously listed as *Berberis vulgaris.* Mr Healy's plant is noted as a "garden escape".

PAPILIONOIDEAE

Ononis spinosa L. ssp. *spinosa.*

Canterbury, Templeton, roadside in grass, 1966, A.J. Healy & B.E.V. Parham 66/77, AK 163128, det. A.J. Healy, (dupl. ex CHR 172892).

Restharrow was first recorded by Allan (1940) as *O. procurrens* Wallr. It was still described as "rare and local" by Webb (1980), South Auckland and Canterbury being the only two areas noted in which it occurs. A note with the above duplicate from CHR reads "persistent from rhizomes thrown out on roadside from infestation in nearby paddock".

UMBELLIFERAE

Coriandrum sativum L.

Auckland, Hobson Street lower end, 1984, R.O. Gardner 4292, AK 167667.

The first record for coriander, from Wellington is by Healy (1948). Canterbury was added to the distribution by Webb (1978) as it was listed for that area by Healy (1968). Dr. Gardner states that his plant is from "one colony in silt of gutter; flowers pinkish".

COMPOSITAE

Aster laevis L.

Taupo Co., Tokaanu Stream, south-west corner of Lake Taupo, 1984, R.O. Gardner 4086, AK 165678.

This is the second sheet of smooth aster in the AK Herbarium, the first being reported by Bangerter (1977) from Auckland. A wide distribution covering both Islands may be found in Given (1984a). The habitat noted for the Taupo specimen is "Common in open disturbed swamp and on (damp?) gravel at roadside".

Calendula arvensis L.

The potential first published record for field marigold by Bangerter (1984) from Auckland is in fact predated by the record by Given (1984b) from Napier, which unfortunately came to my notice too late. The former, therefore, merely publicises a first representative in the AK Herbarium.

SCROPHULARIACEAE

Scrophularia auriculata L.

Bay of Islands Co., Puketi State Forest, bed of Waipapa River, 2km from end of Forest Road, 1985, A.E. Wright 7021, AK 168470; gravel bank in bed of Waipapa River, 1985, A.E. Wright 7056, AK 168471.

Water figwort was first recorded by Allan (1940) according to Sykes (1981). Allan, however, refers to an earlier publication by Smith (1904), where it is listed for Ashburton.

Acknowledgements. For continued encouragement and help in the preparation of this series as well as for the provision of voucher specimens I am again indebted to Mr. A.E. Wright, Botanist at this Museum. For the acquisition of authentically determined material of rare adventives I am grateful to the staff of the Botany Division D.S.I.R. Christchurch. To Dr. R.O. Gardner and Mr. J. Mackinder thanks are also due for collecting and presenting other voucher specimens.

REFERENCES

ALLAN, H. H.

1940 A handbook of the naturalised flora of New Zealand. *N.Z. Dep.Sci.Industr.Res.Bull.* 83 : 1-344.

BANGERTER, E. B.

1977 New and interesting records of adventive plants from the Auckland Institute and Museum Herbarium 3. *Rec.Auckland Inst.Mus.* 14 : 57-62.

1978 New and interesting records of adventive plants from the Auckland Institute and Museum Herbarium 4. *Rec.Auckland Inst.Mus.* 15 : 27-35.

1984 New and interesting records of adventive plants from the Auckland Institute and Museum Herbarium 10. *Rec.Auckland Inst.Mus.* 21 : 69-76.

GARNOCK-JONES, P. J.

1979 Checklist of dicotyledons naturalised in New Zealand 4. Rhoeadales. *N.Z.J.Bot.* 17 : 303-310.

1981 Checklist of dicotyledons naturalised in New Zealand 8. Aizoaceae, Caryophyllaceae and Portulacaceae. *N.Z.J.Bot.* 19 : 59-65.

GIVEN, D. R.

1984a Checklist of dicotyledons naturalised in New Zealand 16. Compositae — tribes Vernonieae, Eupatorieae, Astereae, Inuleae, Heliantheae, Tageteae, Calenduleae and Arctoteae. *N.Z.J.Bot.* 22 : 183-190.

1984b Checklist of dicotyledons naturalised in New Zealand 17. Crassulaceae, Escalloniaceae, Philadelphaceae, Grossulariaceae, Limnanthaceae. *N.Z.J. Bot.* 22: 191-193.

HEALY, A. J.

1948 Contributions to a knowledge of the naturalised flora of New Zealand. No.2. *Trans. Proc.R.Soc.N.Z.* 77 : 172-185.

1969 The adventive flora in Canterbury. In *The Natural History of Canterbury* G.A. Knox (Ed.). A.H. & A.W. Reed, Wellington. pp.261-333.

SMITH, W. W.

1904 Plants naturalised in the county of Ashburton. *Trans.Proc.N.Z.Inst.* 36 : 203-225.

SYKES, W. R.

1981 Checklist of dicotyledons naturalised in New Zealand 7. Scrophulariales. *N.Z.J.Bot.* 19: 53-57.

1982 Checklist of dicotyledons naturalised in New Zealand 12. Haloragales, Myrtales, Proteales, Theales, Violales (excluding Violaceae). *N.Z.J.Bot.* 20 : 73-80.

THOMSON, G. M.

1875 On some naturalised plants of Otago. *Trans.Proc.N.Z.Inst.* 7 : 370-376.

WEBB, C. J.

1978 Checklist of dicotyledons naturalised in New Zealand 1. Umbelliferae. *N.Z.J.Bot.* 16 : 387-390.

1980 Checklist of dicotyledons naturalised in New Zealand 5. Leguminosae. *N.Z.J.Bot.* 18 : 463-472.

THE TAXONOMY OF SOME INDO-PACIFIC MOLLUSCA

PART 12. WITH REMARKS ON TWO AMERICAN GASTROPOD SPECIES

W. O. CERNOHORSKY

AUCKLAND INSTITUTE AND MUSEUM

Abstract. New geographical range extensions are recorded for *Nassarius (Hima) rotundus* (Melvill & Standen), *Neocancilla takiisaoi* (Kuroda) and *Glycymeris (Tucetona) pectunculus* (Linnaeus). *Chicoreus aculeatus* (Lamarck, 1822) is the correct name for *C.artemis* Radwin & D'Attilio, 1976, and *Coralliophila violacea* (Kiener, 1836) must be retained in nomenclature in preference to the homonymous *Fusus neritoideus* Lamarck, 1816. The taxon *Chicoreus trivialis* (A. Adams) is elucidated on the basis of its type-specimens and *Engina mactanensis* from the Philippines and *Mitra dondani* from the Western Pacific are described as new species. *Vexillum (Pusia) zythochroum* (Melvill) is a valid species from Florida, while the Mississippian Oligocene *"Vexillum (Costellaria) tallahalaensis"* Dockery in MacNeil & Dockery, is here re-assigned to *Mitrolumna (Cymakra)* in the family Turridae. The subfamilial turrid name Drilliinae Morrison, 1966, must replace the homonymous Clavinae Casey, 1904, and the family name Hamineidae Pilsbry, 1895, has priority over the homonymous Atyidae Thiele, 1925.

Family MURICIDAE

Genus **Chicoreus** Montfort, 1810

Chicoreus Montfort, 1810, Conchyl. Syst. 2:611. Type species (Opinion 911 of ICZN) *Murex ramosus* Linnaeus, 1758. Recent, Indo-Pacific.

Chicoreus aculeatus (Lamarck, 1822) (Figs. 1-3)

1822. *Murex aculeatus* Lamarck, Hist.nat.anim.s.vert. 7:163; 1842 Kiener, Spéc.gén.icon.coq. viv. 7:27, pl.39, fig.3.

1976. *Chicoreus artemis* Radwin & D'Attilio, Murex shells world, p.32, pl.4, fig.4 (nom. subst. pro *Murex aculeatus* Lamarck, 1822).

TYPE LOCALITY. None.

The taxon *Murex aculeatus* Lamarck, 1822, a member of the *Chicoreus* group, has had an eventful taxonomic history during the past 14 years. E.H. Vokes (1970) considered *Murex aculeatus* Lamarck, 1822, to be a homonym of *Aranea aculeata* Perry, 1811, and *Muricites aculeatus* Schlotheim, 1820 (= *Tympanotonos* spec.), and E.H. Vokes (1971) confirmed her 1970 treatment of homonymy. Cernohorsky (1971) disagreed with E.H. Vokes' interpretation of the Law of Homonymy as laid down by the Code of the International Commission on Zoological Nomenclature (1961). E.H. Vokes (1972) gave a detailed explanation as to her reasons for considering *Murex aculeatus* Lamarck to be a homonym.

Hubbard (1973) disagreed with E.H. Vokes' interpretation of the Law of Homonymy and stated that since *Murex* and *Muricites* are not homonyms, *Murex aculeatus* Lamarck, 1822, cannot be a homonym of *Muricites aculeatus* Schlotheim, 1820.

Fair (1976) followed E.H. Vokes' interpretation and considered *Chicoreus aculeatus* (Lamarck) to be a homonym requiring a replacement name.

Radwin & D'Attilio (1976) also considered *Murex aculeatus* Lamarck, 1822, to be a homonym of *Muricites aculeatus* Schlotheim, 1820, and proposed *Chicoreus artemis* as a replacement name.

D'Attilio (1979) illustrated the variability of *Chicoreus aculeatus* but continued using *C.artemis* for the species.

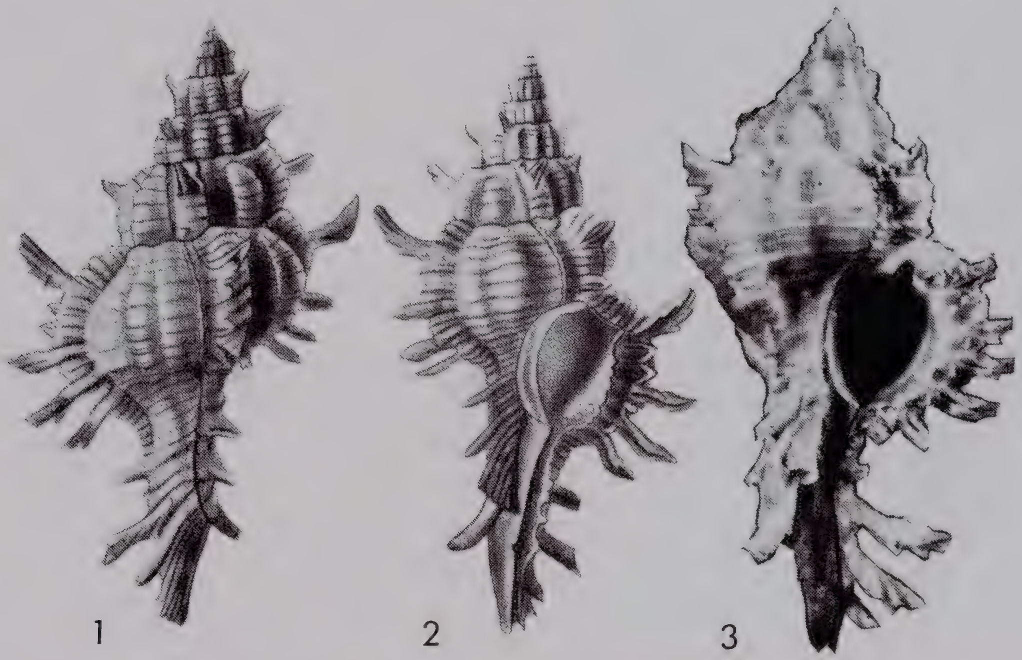
Houart (1981, 1983a) followed E.H. Vokes and used *Chicoreus artemis* Radwin & D'Attilio in preference to *C.aculeatus* (Lamarck).

Abbot & Dance (1982) considered *Chicoreus aculeatus* (Lamarck) as the valid taxon, and placed *C.artemis* Radwin & D'Attilio in synonymy.

Mühlhäusser & de Couet (1982) and de Couet & Mühlhäusser (1983) disagreed with E.H. Vokes' and Houart's interpretation of the Code of ICZN on homonymy and considered *Chicoreus aculeatus* (Lamarck) as the valid name for the species.

With such a divided opinion concerning the interpretation of the Law of Homonymy (Article 57 of the Code of ICZN) among workers, it became clear that no taxonomic stability could ever be achieved, and this author requested the International Commission on Zoological Nomenclature for a ruling in this case. The reply received from Mr. R.V. Melville, Secretary of the ICZN (letters dated 18 July 1983 and 7 September 1983) confirmed the taxon *Murex aculeatus* Lamarck, 1822, as the valid name for the species later re-named *Chicoreus artemis* Radwin & D'Attilio. The Secretary pointed out that no primary homonymy is involved between *Aranea aculeata* Perry, 1811, *Muricites aculeatus* Schlotheim, 1820, and *Murex aculeatus* Lamarck, 1822, and secondary homonymy is also excluded since Perry's *aculeata* belongs to *Murex s.str.,* Schlotheim's *aculeatus* is a *Tympanotonos* species, family Potamididae, and Lamarck's *aculeatus* belongs to *Chicoreus* Montfort. In addition, *Muricites* Schlotheim is unavailable under article 20 of the Code of ICZN.

Now that the Commission has clarified the usage of the taxon *Chicoreus aculeatus* (Lamarck), muricid specialists should determine the real identity of the species through designation of a neotype, since the type-specimen is no longer extant, the original description is ambiguous in so far that it could equally well apply to some other closely



Figs. 1-3. *Chicoreus aculeatus* (Lamarck). 1,2. Illustration from Kiener (1842, pl.39, fig.3). 3. Specimen from Momi lighthouse, Viti Levu, Fiji Is, 27m; 35.0mm.

related species, and the species has not been illustrated by the original author. Greater importance should be given to Kiener's interpretation of *Chicoreus aculeatus* (Lamarck) [Kiener, 1842, pl.39, fig.3] (Figs. 1,2), who examined specimens from the Lamarck collection and the "museum" (Museum National d'Histoire Naturelle, Paris) rather than a subsequent interpretation by Reeve (1845, pl.15, sp.60). Reeve's illustrated *"Murex aculeatus"* has been recently described as *Chicoreus nobilis* by Shikama (1977).

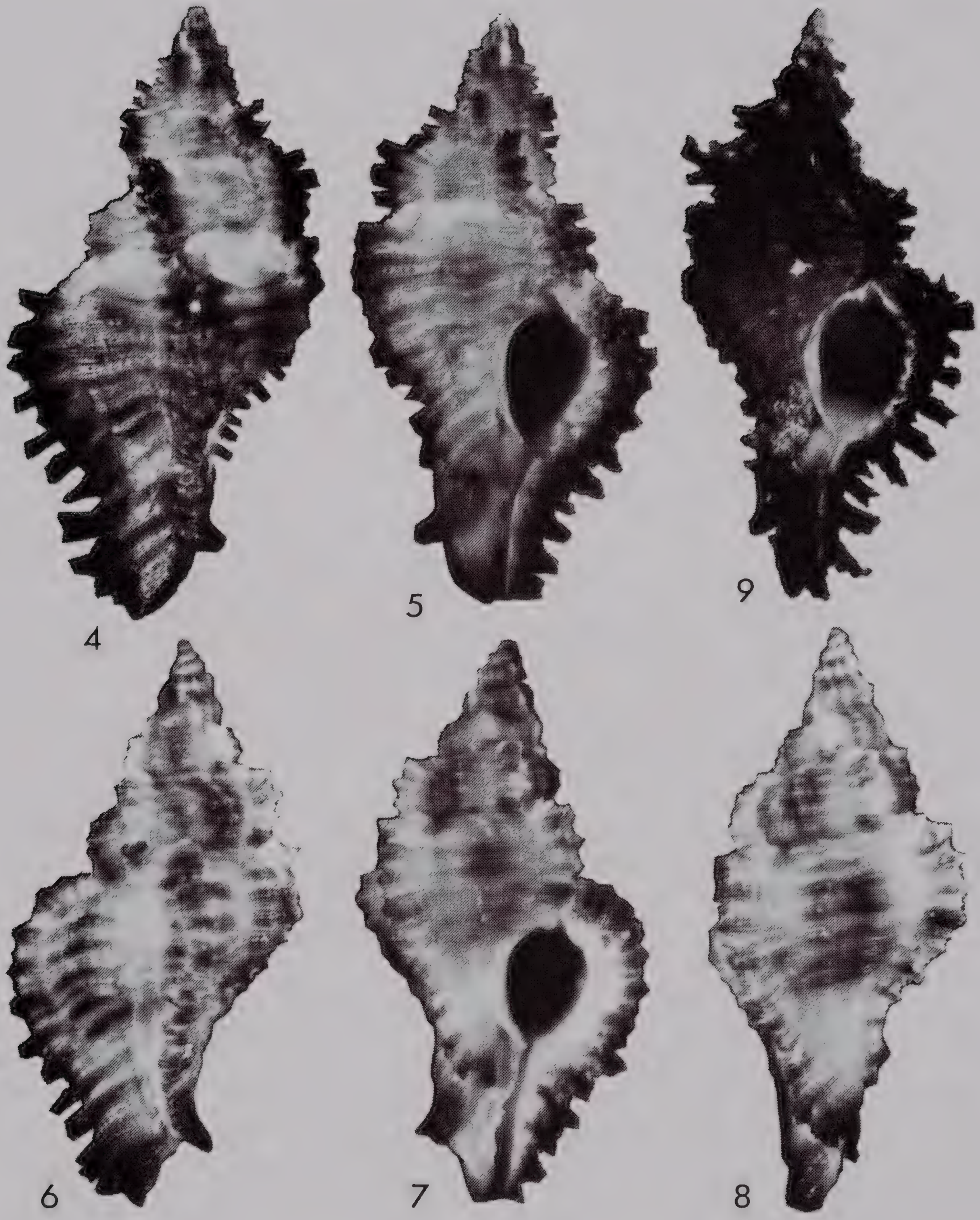
Chicoreus trivialis (A. Adams, 1854) (Figs. 4-8)

1854. *Murex trivialis* A. Adams, Proc.Zool.Soc.Lond. Pt.21:71; 1879 Sowerby, Thes. Conchyl. 4(33/34):16, pl.9, fig.80.

1982. *Chicoreus trivialis* (A. Adams), Abbott & Dance, Compendium Seashells p.137, row 2, second fig. from left.

TYPE LOCALITY. None.

Type specimens. Two syntypes of *C.trivialis* (A. Adams) are in the British Museum (Nat. Hist.), London, No. 1980136, and the larger specimen measuring length 37.7 mm, width 18.9 mm, is here selected as the lectotype (Figs. 4,5). The lectotype has 7 mature whorls and a missing protoconch, 3 varices per whorl, first 4 post-embryonic whorls with 2 intervarical nodes, last 3 whorls with only 1 intervarical node, outer lip with 7 denticles, columella smooth. The smaller paralectotype (Figs. 6-8), length 24.3 mm, width 12.5 mm, has 6 mature whorls and a protoconch of 1¾ embryonic whorls, 2 intervarical nodes and *c.* 9 lirate denticles on the outer lip.



Figs. 4-9. 4-8. *Chicoreus trivialis* (A. Adams). 4,5. Lectotype B.M.(N.H.) No. 1980136; 37.7mm. 6-8. Paralectotype B.M.(N.H.) No. 1980136; 24.3m. 9. *C.paini* Houart, paratype; 45.2mm (from Houart 1983, pl.1. fig.4).

The identity of *Chicoreus trivialis* (A. Adams) has been frequently misinterpreted in literature. Houart (1983b) in comparing his new species *C.paini* with *C.trivialis,* remarked: "the true *C.trivialis* is very well illustrated in Radwin & D'Attilio, 1976, pl.6, fig.12". The species illustrated by Radwin & D'Attilio (1976), however, is very dissimilar to the existing two syntypes of *C.trivialis,* and is most certainly a form of *C.brunneus* (Link). Houart (1983b) states that *C.trivialis* has only 1 intervarical node, but the lectotype has the upper spire whorls with 2 intervarical nodes and the last 3 whorls with 1 intervarical node, and the paralectotype has 2 intervarical nodes.

Chicoreus trivialis is correctly illustrated by Abbott & Dance (1982: 137). In view of the misinterpretation of the identity of *C.trivialis,* the description of *C.paini* Houart, 1983 (synonym is *C.kengaluae* Mühlhäusser & Alf, 1983) should be re-examined because the paratype of *C.paini* from the Banda Sea, Indonesia (Fig.9) appears to be *C.trivialis* (A. Adams).

Family CORALLIOPHILIDAE

Genus **Coralliophila** H. & A. Adams, 1853

Coralliophila H. & A. Adams, 1853, Gen.Rec.Moll. 1:135. Type species by SD (Cossmann, 1903) *Purpura neritoidea* (Lamarck) = *P.violacea* Kiener, 1836. Recent, Indo-Pacific.

Rehder (1980) accepted Cossmann's (1903) earlier type designation for the genus. This type designation meets the requirements of Article 69(a)(i) of the Code of ICZN.

Coralliophila violacea (Kiener, 1836) (Fig.10)

1788. *"Murex neritoideus"* Chemnitz, Neues syst.Conchyl.Cab. 10:280, pl.165, figs. 1577,1578 (non binomial).
1791. *Murex neritoideus* Gmelin, Syst.Nat. ed.13:3559 (ref. Chemnitz, op.cit., figs. 1577,1578 (non Linnaeus, 1767; nec Gmelin, 1791, p.3537).
1816. *Fusus neritoideus* Lamarck, Tabl.Encycl.Méth. p.8, pl.435, figs. 2a,b.
1822. *Pyrula neritoidea* Lamarck, Hist.nat.anim.s.vert. 7:146 (ref.Chemnitz, op.cit., figs. 1577,1578; Gmelin, 1791, p.3559 and Lamarck, 1816, pl.435, figs.2a,b).
1833. *Purpura neritoidea* (Lamk.) Quoy & Gaimard, Voy.L'Astrolabe 2:582, pl.38, figs. 22-24.
1836. *Purpura violacea* Kiener, Spéc.gén.icon.coq.viv. 8:77, pl.19, fig.57 (states that Lamarck placed the species in *Pyrula* with the name *P.neritoidea);* 1846 Reeve, Conch. Icon. pl.12, fig.70.
1836. *Purpura diversiformis* Kiener, *ibid.* 8:pl.19, fig.57.
1846. *Purpura squamulosa* Reeve, Conch.Icon. pl.12, fig.68.
1936. *Coralliophila violacea* (Kiener), Hirase, Coll.Jap.shells ed.5:81, pl.111, fig.8; 1941 Wenz, Handb.Palaeozool. 6(5):1130, fig.3209; 1952 Kuroda & Habe, Check-list & Bibl.Rec.Moll.Japan p.50; 1954 Kira, Col.illust. shells Japan p.51, pl.25, fig.2; 1957 Demond, Pacific Sci. 11(3):315; 1960 Azuma, Cat.Moll.Okinoshima Japan p.37; 1961 Rippingale & McMichael, Queensld. & Gt.Barrier reef shells p.103, pl.13, fig.8; 1963 Shikama, Select.shells world col. 1:77, pl.61, fig.18; 1967 Orr-Maes, Proc.Acad.Nat.Sci.Philadelphia 119(4):133, pl.2, fig.B; 1967 Habe & Kosuge, Stand.book Jap.shells col. 3:73, pl.29, fig.4; 1972 Cernohorsky, Mar. shells Pacific 2:131, pl.37, fig.5; 1974 Quirk & Wolfe, Seashells Hawaii p.11, fig.7; 1975 Coleman, What shell is that p.142, fig.422; 1975 Salvat & Rives, Coquill.Polynésie p.310, fig.189; 1978 Hinton, Guide Austral.shells p.39, fig.2; 1979 Kay, Hawaiian mar.shells p.255,

fig.90c; 1980 Rehder, Smithsonian contrib.Zool. No.289:75.

1957. *Coraliophila (sic) violacea* (Kiener), Kaicher, Indo-Pacific sea shells pl.5, fig.13.

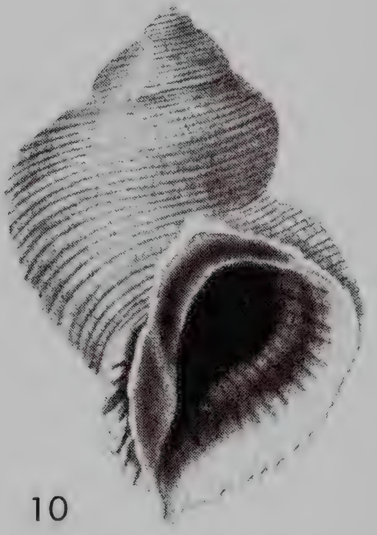
1966. *Coralliobia violacea* (Kiener) Habe & Kosuge, Shells world col. 2:56, pl.20, fig. 17.

1971. *Coralliophila (Coralliophila) neritoides (sic)* (Lamarck), Keen, Sea shells trop.W.America ed.2:543, fig.1061.

1974. *Coralliophila neritoidea* (Lamarck), Dance, Encycl.shells p.139, fig. left column; 1982 Abbott & Dance, Compend.seashells p.155, fig.bottom left; 1984 D'Attilio & Myers, Trans.San Diego Soc.Nat.Hist. 20(5):93, figs.29-31.

TYPE LOCALITY. "Port Dorey, New Guinea" [= Teluk Dore Hum, Geelvink Bay, West Irian] (*violacea* – here designated); none (*Murex neritoideus* Gmelin and *Fusus neritoideus* Lamarck); Nicobar Is; Port Dorey, New Guinea and New Holland (*diversiformis*); Ticao I, Philippines (*squamulosa*).

DISTRIBUTION. Tropical Indo-Pacific.



10

Fig. 10. *Coralliophila violacea* (Kiener). Type figure (from Kiener 1836, pl.19, fig.57).

Despite wide-spread useage of the epithet *violacea* Kiener in malacological literature, Keen (1971), Dance (1974), Abbott & Dance (1982) and D'Attilio & Myers (1984) re-introduced the homonymous taxon *Coralliophila neritoidea* (Lamarck) into coralliophilid systematics, but Keen (in litt. 3-XI-1980) reverted to *C.violacea* as the correct name. It is not only undesirable but taxonomically confusing to have two names for one and the same species in molluscan literature, especially if the species is the type-species of the genus *Coralliophila* H. & A. Adams, and it is imperative that the correct name applicable to the taxon be established.

From the description and illustrations of the taxa *Murex neritoideus* Gmelin, 1791 (non Linnaeus, 1767) and *Fusus neritoideus* Lamarck, 1816, it can be clearly established that these two taxa in question are one and the same biological entity and not only congeneric but also conspecific. It is probable that Lamarck (1816) intended a generic re-assignment of Gmelin's *neritoideus* to *Fusus,* although there is no evidence of this in Lamarck's (1816) work where all taxa lack author's names. Six years later, however, Lamarck (1822) re-assigned *neritoideus* to the genus *Pyrula* but this time appended a reference to "Gmelin, p.3559" and thus clearly associating the name with an earlier author. Kiener (1835-36) recognized Lamarck's homonymous useage of *neritoideus* and proposed the replacement name *Purpura violacea.* This taxon, in the combination *Coralliophila violacea* (Kiener) has been used almost exclusively until 1971.

Fusus neritoideus Lamarck, 1816, is not only a subjective synonym of *Murex neritoideus* Gmelin, 1791, but since both taxa belong to the same genus *Coralliophila,* the former is a junior secondary homonym of the latter (Art. 59(b) of the Code of ICZN). The amended Code of ICZN (Art. 59(b)(i)) makes it also quite clear that a junior secondary homonym rejected prior to 1961 is permanently rejected.

Rehder (1980) stated that Kiener mentioned the localities Nicobar Is, Port Dorey, New Guinea and "New Caledonia" for his *Purpura violacea.* The latter locality must be a *lapsus* for "Nouvelle-Hollande" [= New Holland = Australia] cited by Kiener (1835-36), and one of the original cited localities must be selected as the type locality. I have re-designated "Port Dorey, New Guinea" (now Teluk Dore Hum, Geelvink Bay, W. Irian) as the type locality, this being the centre of the species distributional range.

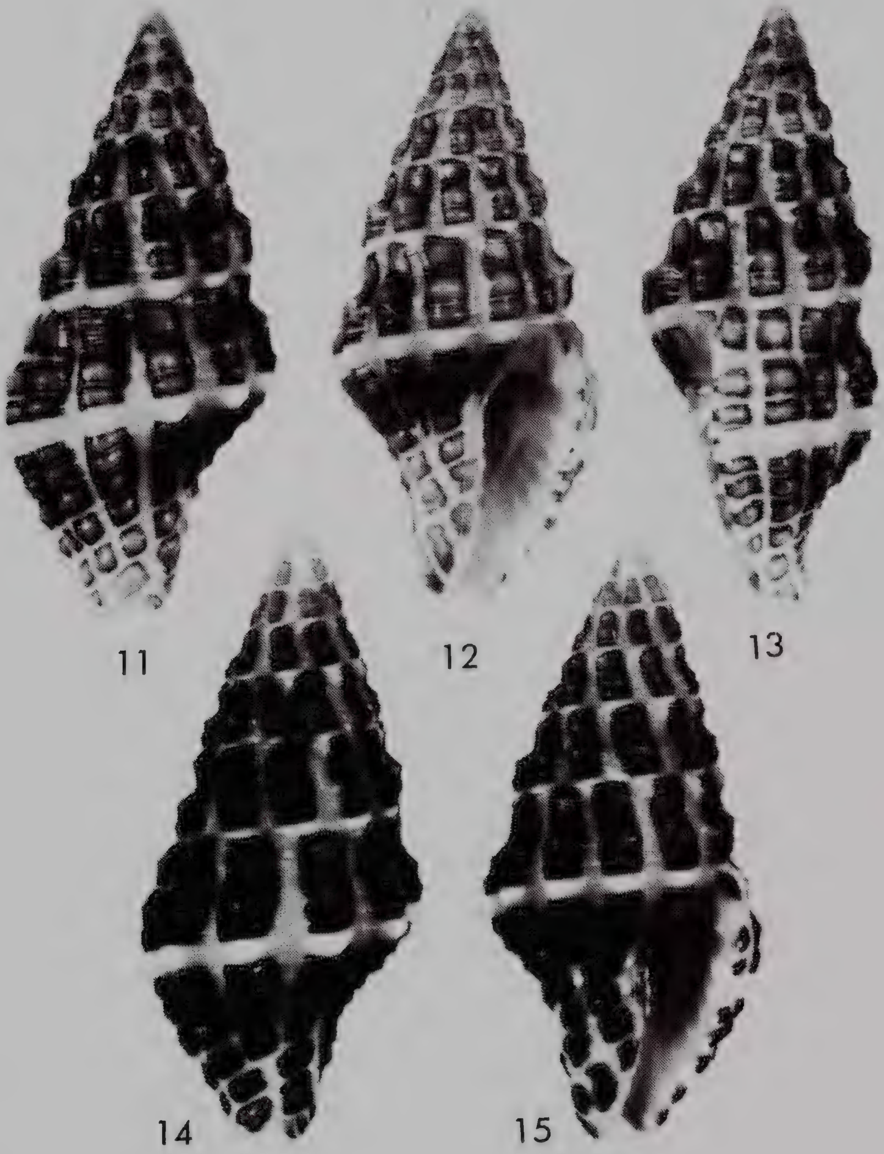
Family BUCCINIDAE

Genus **Engina** Gray, 1839

Engina Gray, 1839, Zool.Capt.Beechey's Voy. "Blossom" p.112. Type species by SD (Gray, 1847) *E.zonata* Gray, 1839 = *Purpura turbinella* Kiener, 1836. Recent, Caribbean.

Engina mactanensis sp. n. (Figs. 11-16)

Shell up to 12.0 mm in length (range 7.6mm — 12.0mm), solid, elongate-biconic, body whorl centrally angulate, sutures adpressed and wavy, width 42-48% of shell-length, teleoconch of 5½-6¼ concavo-convex whorls, protoconch of 3-3¼ shining white, smooth embryonic whorls which are ornamented with small, irregular, round or elliptical brown spots. Whorls prominently concave below sutures, sculptured with prominent, roundly angulate axial ribs which number from 10-11 on the penultimate and from 9-11 on the body whorl. Laterally elongate nodules form on axial ribs and number from 3-4 on the penultimate and from 9-11 on the body whorl, anterior row of sutural nodules compressed; numerous macroscopic spiral striae encircle shell on all whorls. Aperture about equal in height to the spire, moderately narrow, outer lip thickened and with 6-7 shortly lirate denticles, first posterior denticle larger and forming part of anal canal, columella calloused and prominently radially lirate up to parietal denticle, siphonal canal straight or only weakly curved, siphonal notch distinct. Base colour bluish-white or pale grey, axial ribs ornamented with quadrate or rectangular, close-set, tan-coloured spots which are ringed with dark brown, anterior row of sutural nodules and central row of nodules on body whorl white; aperture white, edge of outer lip with small brown spots.

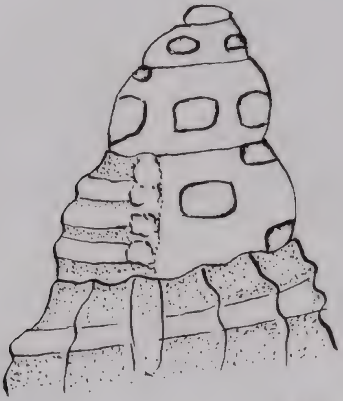


Figs. 11-15. *Engina mactanensis* sp. n. 11-13. Holotype AIM No. TM-1371; 11.1mm. 14,15. Paratype from Punta Engano, Mactan I, Cebu, Philippines; 10.4mm.

TYPE LOCALITY. Punta Engano, Mactan I, Cebu, Philippines, in shell nets at a depth of 300m.

Holotype. In the Auckland Institute and Museum No. TM-1371, length 11.1 mm, width 5.0 mm, height of aperture 5.6 mm (Figs. 11-13).

Paratypes. A total of 105 paratypes have been examined: 102 came from the type locality, 2 from Balicasag I, Bohol, Philippines, 146 m, and 1 from Bohol Straits, Philippines, 92m-110 m. Paratypes are in the Australian Museum, Sydney, the British Museum (Natural History), London, the National Museum of Natural History, Smithsonian Institution, Washington, and coll. G.T. Watters, Ohio State University, U.S.A.



16

Fig. 16. Protoconch of *Engina mactanensis* sp. n.

This new *Engina* species is to date known only from the Philippine Islands where it appears to be reasonably common at depths ranging 100-300m. *Engina mactanensis* is not similar to any previously described *Engina* species, and is easily recognised by features of concave presutural ramp and the tan-coloured ocellated spots on the axial ribs and protoconch.

Family NASSARIIDAE

Genus **Nassarius** Dumeril, 1806

Nassarius Dumeril, 1806, Zool.Analytique p.166. Type species by SM (Froriep, 1806) *Buccinum arcularia* Linnaeus, 1758. Recent, Indo-Pacific.

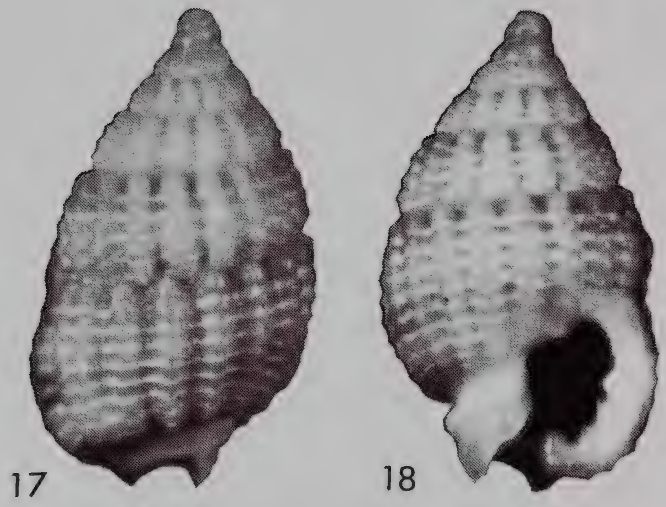
Subgenus **Hima** Leach in Gray, 1852

Hima Leach in Gray, 1852, Moll.Britt.Synop. P.123. Type species by SD (Marwick, 1931) *Buccinum minutum* Pennant, 1777 = *B.incrassatum* Ström, 1768. Recent, Mediterranean.

Nassarius (Hima) rotundus (Melvill & Standen, 1896) (Figs.17, 18)

1896. *Nassa (Niotha) rotunda* Melvill & Standen, J.Conch. 8:273, pl.9, fig.2; 1899 Melvill & Standen, J.Linn.Soc.Lond.Zool. 27:160.

1972. *Nassarius (Hima) rotundus* (Melvill & Standen), Cernohorsky, Rec. Auckland Inst.Mus. 9:187, fig.155; 1984 Cernohorsky, Bull.Auckland Inst.Mus. 14:178, pl.37, figs.15-17.



Figs. 17,18. *Nassarius (Hima) rotundus* (Melvill & Standen). N.W. side of Heron I, Capricorn group, Qld., Australia; 6.2mm.

TYPE LOCALITY Lifu, Loyalty Is.

Although reported by Melvill & Standen (1899) from Warrior I, Torres Straits, all previous specimens of *N.rotundus* examined originated from Lifu I, Loyalty Is. The collection of a specimen from the N.W. side of Heron I, Great Barrier reef, Australia (*leg.* R. C. Willan) confirms the species range-extension to the East Australian mainland.

Family MITRIDAE

Genus **Mitra** Lamarck, 1798

Mitra Lamarck, 1798, Tabl.Encycl.Meth. pl.369. Type species by T *Voluta mitra* Linnaeus, 1758. Recent, Indo-Pacific.

Mitra dondani sp. n. (Figs. 19-24)

Shell moderate in size, up to 50.0 mm in length, fusiformly-elongate, width 24%-28% of length, solid, shining and smooth in appearance, teleoconch of 7½-8½ weakly convex whorls, protoconch missing in all specimens examined, sutures adpressed. Early mature whorls granulose, axial sculpture disappearing and spiral sculpture becoming very fine and weak on later whorls; penultimate whorl with 20-30 weak, fine, macroscopically finely punctate spiral striae, body whorl with 56-68 striae, striae becoming slightly wider spaced on siphonal fasciole. Aperture very narrow, about equal in height to the spire, height 48%-51% of length, smooth within, outer lip weakly convex, thickened and simple at margin in adult specimens, columella not calloused and only with a narrow shining glaze and with 6-8 (usually 7) close-set, oblique folds. Base colour white to pale bluish-white, ornamented with dark brown, moderately wide-spaced axial streaks which extend from suture to suture on spire whorls but are interrupted centrally on body whorl by a broad zone of the base colour; additional ornamentation consists of moderately straight dark brown axial lines which are bisected by stronger primary and finer secondary lines of the same colour; penultimate whorl with 3 main spirals plus 1-3 intermediate ones, body whorl with 9-13 primary lines and 5-9 intermediate ones, aperture white, edge of outer lip with 5-10 small brown spots.

TYPE LOCALITY. Panlao, Bohol, Philippines, by net in *c.* 220 m.

DISTRIBUTION. From the Philippines to the Ryukyu Islands and Papua New Guinea.

Holotype. In the Auckland Institute and Museum No. TM-1370, length 36.0 mm, width 9.6 mm, height of aperture 18.5 mm (Figs. 19,20).

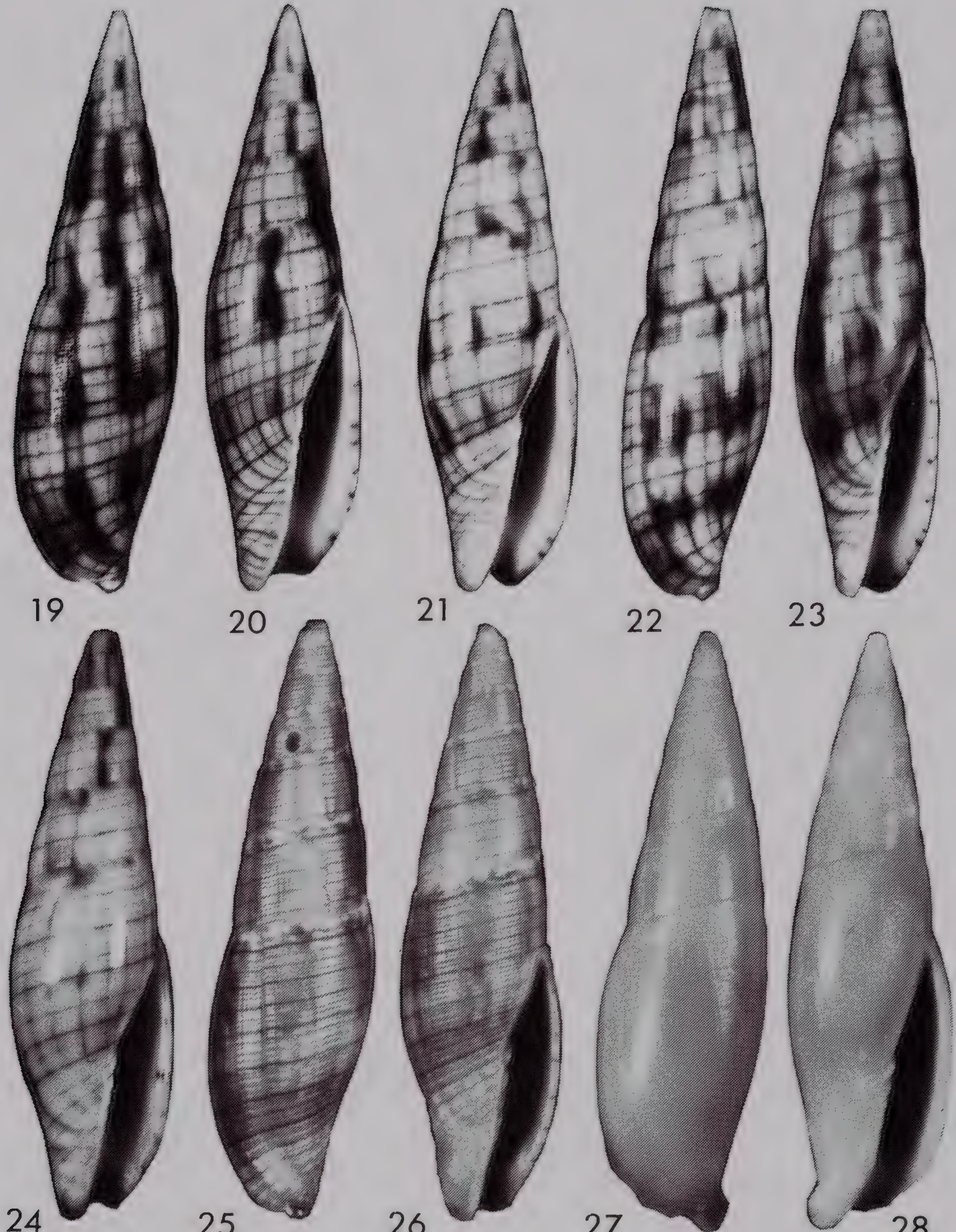
Paratypes. Paratypes from the type locality are in coll. P.Clover, V.Dan, H.Eker and AIM; paratype from Punta Engano, Mactan I, Philippines, in coll. S.Gori, length 45.0 mm, width 11.5 mm; paratypes from Talikud I, Davao, Philippines, in coll. A.Deynzer, with the largest paratype measuring 50.2 mm; paratypes from Seragaki, Okinawa, Ryukyu Islands, in coll. A.Deynzer; paratype length 31.0 mm, width 6.5 mm, from off Kimbe, New Britain, Papua New Guinea, in coll. A.Richards.

Mitra dondani resembles *M.deynzeri* Cernohorsky (Figs. 25,26), *M.ancillides* Broderip (Figs. 27,28) and *M.ustulata* Reeve (Figs. 29,30), and diagnostic characters separating these four species are given in Table 1. *M.dondani* does have a glossier shell than the other three species and the sculpture is considerably finer than in *M.ustualata* and *M.deynzeri.* Only *M.deynzeri* has a similar colour pattern, but the brown axial lines in *M.dondani* are absent in *M.deynzeri,* and the distinct white-spotted, bi-cordate sutural girdle of *M. deynzeri* is lacking in the other three species.

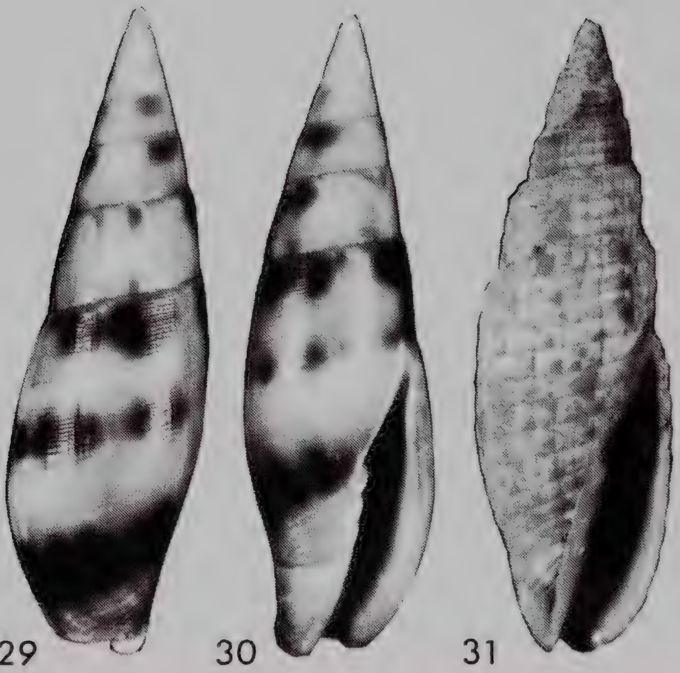
The species is name for Mr. Donald Dan, Oak Brook, Illinois, U.S.A., who many years ago made molluscan material from the Philippines available for research.

Table 1. Main diagnostic characters of 4 related Mitridae species.

Characters	*dondani*	*deynzeri*	*ancillides*	*ustulata*
Length in "mm"	34.0-50.0	13.0-27.0	19.0-24.0	29.0-53.0
Width in % of length	24%-28%	22%-29%	27%-30%	29%-39%
Spiral striae on penult whorl	20-30	7-17	22-23	8-24
Spiral striae body whorl	56-68	28-45	60-65	25-60
Sutural girdle	absent	present	absent	absent
Columellar folds	6-8	5-6	5-7	6-8
Brown spiral lines on penult whorl	3 + 1 to 3	4-7	absent	absent
Brown spiral lines on body whorl	9-14 + 5-9	10-15	absent	absent
Brown axial lines	present	absent	absent	absent
Distribution	Philippines - Ryukyu Is	Indo-West Pacific	Tuamotus - Marquesas	Indo-Pacific



Figs. 19-28. 19-24. *Mitra dondani* sp. n. 19,20. Holotype AIM No. TM-1370; 36.8mm. 21. Paratype from Punta Engano, Mactan I, Cebu, Philippines; 35.7mm. 22,23. Slender paratype from same locality; 40.9 + mm. 24. Paratype from Seragaki, Okinawa, Ryukyu Is; 36.5 + mm. 25,26. *M.deynzeri* Cernohorsky, holotype AIM No. TM-1363; 26.7 + mm. 27,28. *M.ancillides* Broderip, holotype B.M. (N.H.) No. 1967712; 23.8mm.



Figs. 29-31. 29,30. *Mitra ustulata* Reeve. Helengeli, Maldive Is, 25m; 28.5mm. 31. *Neocancilla takiisaoi* (Kuroda). E. of Pt.Cartwright, Mooloolaba, N. of Brisbane, Qld., Australia, 15m; 46.6mm.

Genus **Neocancilla** Cernohorsky, 1966

Neocancilla Cernohorsky, 1966, Veliger 9(2):110. Type specis by OD *Voluta papilio* Link, 1807. Recent, Indo-Pacific.

Neocancilla takiisaoi (Kuroda, 1959) (Fig.31)

1958. *Mitra taki-isaoi* Kuroda, Venus:Jap.J.Malac. 20(2):pl.21, fig.10 (nomen nudum).
1959. *Mitra (Scabricola) takiisaoi* Kuroda, Venus:Jap.J.Malc. 20(4):326; 1963 Shikama, Select.shells world col. 1:pl.74, fig.10.
1970. *Neocancilla takiisaoi* (Kuroda), Cernohorsky, Bull.Auckland Inst.Mus. No.8:18, textfig.108 (radula), pl.7, fig.12 (shell); 1978 Cernohorsky, Rec.Auckland Inst.Mus. 15:58, fig.6 (shell), fig.7 (SEM of radula); 1980 Pechar, Prior & Parkinson, Mitre shells Pacific & Indian Oceans, frontispiece.

TYPE LOCALITY. Hachijo-jima, Izu-schichito Is, Japan.

Originally described from Japan, the species has been subsequently collected in the Pitcairn Is by the "Pele" expedition, and further collections were made in the Kermadec Is and New Caledonia. The specimen collected alive E. of Pt. Cartwright, Mooloolaba, N. of Brisbane, Queensland in only 15m depth (*leg.* R.C. Willan) is the first record of this rare species from the East Australian mainland.

Family COSTELLARIIDAE

Genus **Vexillum** Röding, 1798

Vexillum Röding, 1798, Mus.Bolten. p.138. Type species by SD (Woodring, 1928) *V.plicatum* Röding, 1798 = *Voluta plicaria* Linnaeus, 1758. Recent, Indo-Pacific.

Subgenus **Pusia** Swainson, 1840

Pusia Swainson, 1840, Treat.Malac. p.320. Type species by M *P.microzonis* (Lamarck) = *Mitra microzonias* Lamarck, 1811. Recent, Indo-Pacific.

Vexillum (Pusia) zythochroum (Melvill, 1888) (Figs. 32-36)

1888. *Mitra zythochroa* Melvill, J.Conch. 5:287, pl.2, fig.24.

TYPE LOCALITY. None.

Type specimen. Holotype in the National Museum of Wales, Cardiff No.1955.158.430., length 10.2 mm, width 4.0 mm, height of aperture 4.6 mm. The type has 7 whorls and a broken protoconch, 24 axial ribs and 5 spiral threads on the penultimate and 24 ribs, 10 spiral threads and 11 nodulose basal cords on the body whorl, a row of small nodules on suture, 8 strong lirae on outer lip, and 5 oblique folds on columella (Figs. 32,33).

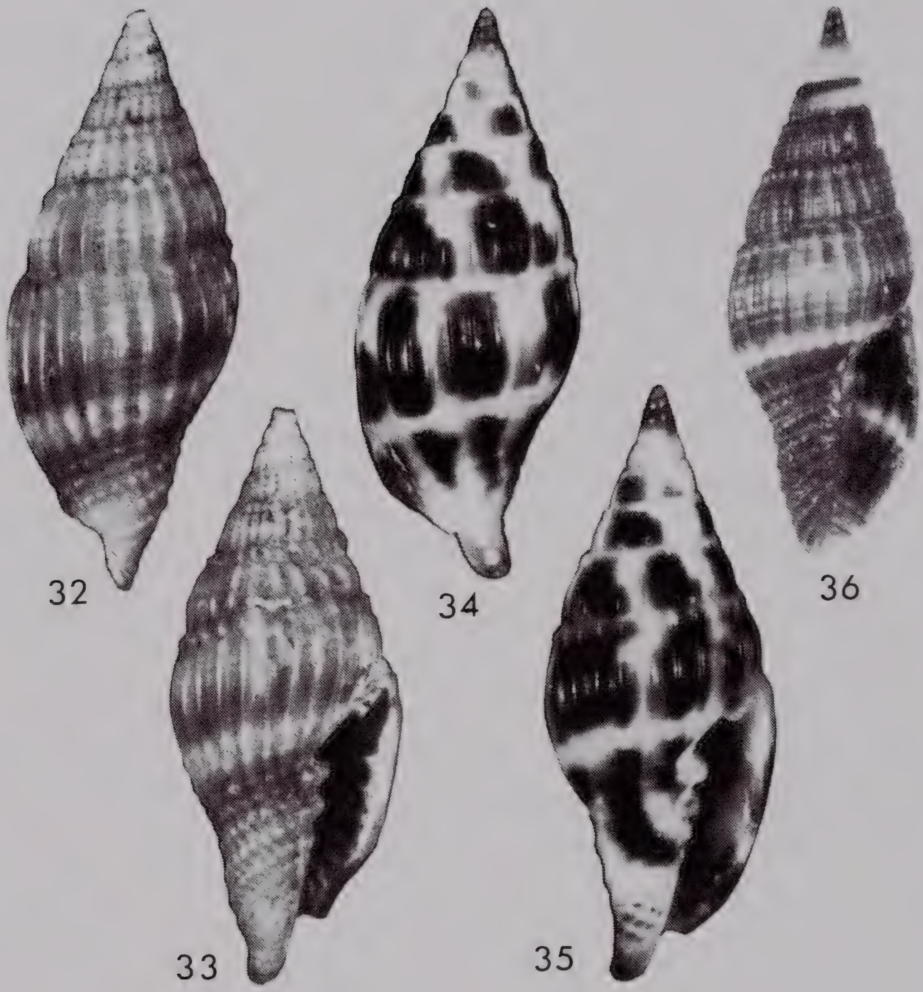
Recent specimens from Pompano beach, Florida, U.S.A., collected in 12-18 m depth under coral rubble and rock piles (*leg.* L.C. Hill, Miami, Florida), have 6 mature whorls and 4 glassy-brown embryonic whorls, 26 axial ribs on the penultimate and the same number on the body whorl, weak or more prominent spiral striae, a row of sutural nodules, lower half of the body whorl with 10-11 rows of nodulose cords, 5 columellar folds, 5 lirae on the interior of the outer lip and a prominent parietal denticle. Shells are either creamy-white, ornamented with chocolate-brown blotches or uniformly chocolate-brown with 2½ post-embryonic whorls white (Figs. 34-36).

The species is closely similar to the Indo-Pacific *V. (P.) catenatum* (Broderip, 1836). Morphological differences between the two species are yet to be established, but it is suspected that *V. (P.) catenatum* will prove to have fewer embryonic whorls than *V. (P.) zythochroum.*

Family TURRIDAE

Subfamily DRILLIINAE Morrison, 1966

Clavinae (*ex*-Clavini) Casey, 1904, Trans.Acad.Sci.St.Louis 14(5):158 (non McCrady, 1859).
Clavinae Powell, 1942, Bull.Auckland Inst.Mus. 2:29, 32, 84 (non McCrady, 1859).
Drilliinae Morrison, 1966, Ann.Repts.Americ.Malac.Union p.2.



Figs. 32-36. *Vexillum (Pusia) zythochroum* (Melvill). 32,33. Holotype National Museum of Wales, Cardiff No. 1955.158.430.; 10.2mm. 34,35. Specimen from Pompano beach, E.Florida, U.S.A., 12m-18m; 10.4mm. 36. Slender immature specimen from same locality; 9.7mm.

The useage of the family-group name Clavidae in Coelenterata has been brought to my attention through a recent paper by His Majesty the Emperor of Japan (Hirohito 1983). The Emperor (through courtesy of Dr.T. Habe) has informed me that the family-group name Clavidae has been used in Hydrozoa since its establishment by McCrady in 1859.

Since all family-group names are of co-ordinate status in nomenclature (Article 36 of the Code of ICZN), Clavidae McCrady, 1859 (based on *Clava* Gmelin, 1791, which is not a homonym of the suppressed *"Clava"* Martyn, 1784) in Coelenterata has chronological priority over Clavinae Casey, 1904 (based on *Clavus* Montfort, 1810) in the family Turridae, in Mollusca. Both family-group names are in frequent use in Coelenterata (from Allman 1872 through to Hirohito 1983) and in Mollusca (Powell 1966; Keen 1971; Maes 1983; Cernohorsky 1983, etc.). It should also be pointed out that some authors erroneously credit Powell (1942) rather than Casey (1904) with the authorship of the molluscan Clavinae.

I agree with Keen (1971) and Maes (1983) that *Drillia* Gray, 1833, is assignable to the same subfamily as *Clavus* Montfort, 1810, and Drilliinae Morrison, 1966, will thus replace the homonymous molluscan Clavinae Casey, 1904.

Subfamily MITROMORPHINAE Casey, 1904

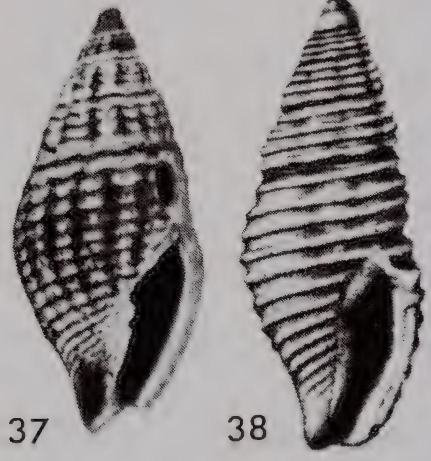
Genus **Mitrolumna** Bucquoy, Dautzenberg & Dollfus, 1883

Mitrolumna Bucquoy, Dautzenberg & Dollfus, 1883, Mol.mar.Roussillon 1(3):115, 121. Type species by OD *Mitra olivoidea* Cantraine, 1835. Recent, Mediterranean.

Subgenus **Cymakra** Gardner, 1937

Cymakra Gardner, 1937, U.S.Geol.Surv.Prof.Pap. 142F:421. Type species by OD *C.poncei* Gardner, 1937 = *Mitromorpha mitrodita* Gardner & Aldrich, 1919. Miocene of the Eastern United States.

Species of *Cymakra* also have a paucispiral protoconch, biplicate columella and lirate interior of the outer lip as in *Mitrolumna,* but shells are more biconic, less inflated, with more distinct and sometimes channeled sutures and a coarser sculpture of spiral cords, axial ribs or granules.



Figs. 37,38. 37. *Mitrolumna (Cymakra) tallahalaensis* (Dockery in MacNeil & Dockery). Holotype USMN. No. 376674; 5.0mm. 38. *M (C.) mitrodita* (Gardner & Aldrich). Illustrated holotype; 5.5mm (from Gardner & Aldrich 1919, pl.1, fig.7).

Mitrolumna (Cymakra) tallahalaensis (Dockery in MacNeil & Dockery, 1984) (Fig.37)

1984. *Vexillum (Costellaria) tallahalaensis* Dockery in MacNeil & Dockery, Bull.Mississippi Dept.Nat.Res.Bur.Geol. 124:162, pl.58, fig.12.

TYPE LOCALITY. MGS 93, stream bed of West Tallahala creek, Smith Co., Byram formation, Vicksburg group, Lower Oligocene of Mississippi.

This Vicksburg Oligocene species has mistakenly been placed in the wrong genus and family by Dockery (in MacNeil & Dockery 1984). The holotype USNM 376674, length 5.0 mm, with 2.0 mm, is a typical mitromorphine turrid of the genus *Mitrolumna,* and is rather similar to the South Carolina Miocene *Mitrolumna (Cymakra) mitrodita* (Gardner & Aldrich, 1919) [Fig. 38]. Species of the subgenus *Cymakra* are known from Miocene deposits of South Carolina and Florida, and the Vicksburg Lower Oligocene *M.(C.) tallahalaensis* is thus the oldest *Mitrolumna* from the new world. In Europe, *Mitrolumna s.str.* ranges from the Oligocene to Recent.

Order **CEPHALASPIDEA**

Superfamily BULLACEA

Family HAMINEIDAE Pilsbry, 1895

Hamineinae Pilsbry, 1895, Man.Conch. 15:351 (based on *Haminea* Leach in Gray, 1847).
Atyidae Thiele, 1925, Wiss.Ergeb.,deut.Tiefsee-Exp."Valdivia" 17(2):231 (based on *Atys* Montfort, 1810) [non Atyadae de Haan, 1849, Fauna Japonica,Crust.(6):168, 184; nec Atyidae Dana, 1852, Proc.Acad.Nat. Sci. Philadelphia 6:13, 16 — nom.corr.].

The family-group name Atyidae Thiele, 1925 (erroneously credited to Thiele, 1926 in literature) in Mollusca — Opisthobranchia, is in current use in malacological literature (e.g. Wenz 1938; Grassé 1968; Keen 1971; Nordsieck 1972; Rosewater 1975; Powell 1979; Abbott & Dance 1982 etc.). The family-group name Atyidae Thiele, 1925, however, is not only a homonym of the earlier Atyidae de Haan, 1849 (based on *Atya* Leach, 1816) in Decapoda, but is also a synonym of the chronologically prior Hamineidae Pilsbry, 1895.

Thiele (1925) remarked that *Atys* Montfort, 1810, and *Haminea* Leach in Gray, 1847, were so closely related that they have to be placed in the same family-group, a conclusion which seems to be endorsed by most opisthobranch specialists.

The genus-group *Haminea* Leach in Gray, 1847 (type-species *Bulla hydatis* Linnaeus, 1758) erected by Gray (1847) as an independent taxon and not as a replacement name for *Haminoea* Turton & Kingston in Carrington, 1830, as sometimes suggested in literature, is nevertheless an objective synonym of *Haminoea* Turton & Kingston. This synonymy, however, does not disqualify Hamineidae Pilsbry, from valid usage as a family name for the group of opisthobranchs containing species of *Atys* and *Haminoea* (Article 40 of the Code of ICZN).

Family GLYCYMERIDIDAE

Genus **Glycymeris** da Costa, 1778

Glycymeris da Costa, 1778, Hist.Nat.Test.Brit. p.168. Type species by M *G.orbicularis* da Costa, 1778 = *Arca glycymeris* Linnaeus, 1758. Recent, European Seas.

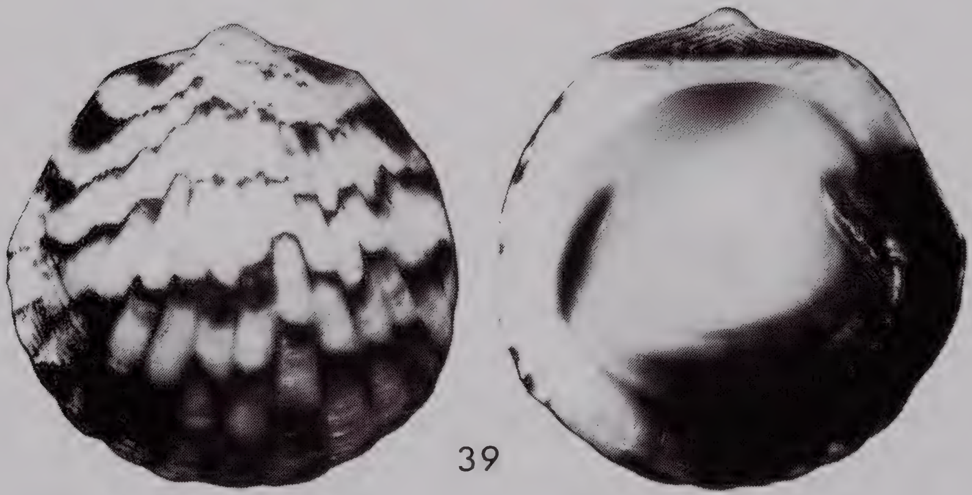
Subgenus **Tucetona** Iredale, 1931

Tucetona Iredale, 1931, Rec.Austral.Mus. 18(4):202, 231. Type species by OD *Pectunculus flabellatus* Tenison-Woods, 1878. Recent, Southern Australia.
1939. *Tucetopsis* Iredale, Gt.Barrier reef Exp.Sci.Rept. 5(6):302. Type species by OD *Cardium amboinense* Gmelin, 1791 = *Arca pectunculus* Linnaeus, 1758. Recent, Indian Ocean.

Glycymeris (Tucetona) pectunculus (Linnaeus, 1758) (Fig.39)

1758. *Arca pectunculus* Linnaeus, Syst.Nat. ed.10:695.
1791. *Cardium amboinense* Gmelin, Syst.Nat. ed.13:3255.
1798. *Arca* spec. Lamarck, Tabl.Encycl.Méth. pl.311, fig.5.
1819. *Pectunculus pectiniformis* Lamarck, Hist.nat.anim.s.vert. 6:53.
1939. *Tucetona amboinensis extra* Iredale, Gt.Barrier reef Exp.Sci.Rept. 5(6):302, pl.4, figs.14,14a,b.

TYPE LOCALITY. American Ocean = error! (*pectunculus*); Amboina, Indonesia (*amboinensis*); Asiatic and American Oceans = latter locality erroneous (*pectiniformis*); Queensland, Australia (*extra*).



39

Fig. 39. *Glycymeris (Tucetona) pectunculus* (Linnaeus, 1758). Tavanipupu I, Marau Sound, Guadalcanal, Solomon Is; 46.0mm.

The species has been previously reported from Queensland, Australia and Papua New Guinea. The recent collection of specimens at Tavanipupu I, Marau Sound, Guadalcanal, Solomon Is (*leg.* N.Gardner), where the species is not uncommon, and Tanna I and Efate I, Vanuatu (*leg.* R.C. Willan), extends the species range farther into the Pacific.

Acknowledgements. I would like to thank His Majesty, the Emperor of Japan, and Dr. T. Habe, Tokai University, Japan for information on Hydrozoan nomenclature. The late Dr. J.Rosewater and Dr. F.M. Bayer, National Museum of Natural History, Smithsonian Institution, Washington, and Dr. L.B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden, furnished information and literature references on the decapod Atyidae. To Dr. F.J. Collier, National Museum of Natural History, Washington, and Dr. P.G. Oliver, National Museum of Wales, Cardiff, I am grateful for the loan of type-specimens.

The following people have kindly supplied specimens and information: Mr. V. Dan, Manila, Philippines; Ms. H.Eker, Phoenix, Arizona; Mr. & Mrs. N. Gardner, Auckland; Mr. S. Gori, Livorno, Italy; Mrs. A. Richards, Kimbe, Papua New Guinea; Dr. M. Keen, formerly of Stanford University, California; Mr. & Mrs. I. Marrow, Hampton, Victoria; Mr. R.V. Melville, International Commission on Zoological Nomenclature, London; Dr. H. Turner, Birmensdorf, Switzerland; Dr. G.T. Watters, Ohio State University, and Dr. R. C. Willan, University of Queensland, Brisbane.

REFERENCES

ABBOTT, R. T., and S. P. DANCE
1982 *Compendium of Seashells.* New York. 411p., col. text-figs.

ALLMAN, G. J.
1872 *A monograph of the gymnoblastic or tubularian hydroids.* Ray Soc. London Pt.2:155-451, pls. 13-23.

CASEY, T. L.
1904 Notes on the Pleurotomidae with descriptions of some new genera and species. *Trans.Acad.Sci.St.Louis* 14(5):123-170.

CERNOHORSKY, W. O.
1971 Contribution to the taxonomy of the Muricidae (Gastropoda: Prosobranchia). *Veliger* 14(2):187-191, textfigs.
1983 The taxonomy of some Indo-Pacific Mollusca. Part 11. *Rec. Auckland Inst.Mus.* 20:185-202, textfigs.

COSSMANN, M.
1903 *Essais de paléoconchologie comparée.* Paris 5:1-215, pls. 1-9.

COUET, H. G. de, and H. MÜHLHÄUSSER
1983 Another view of *Murex aculeatus, M.artemis* and *M.rossiteri. Hawaiian Shell News* 31(3):3-4, textfigs.

DANCE, S. P.
1974 *The Encyclopedia of shells.* London 288p., col. textfigs.

D'ATTILIO, A.
1979 Intraspecific variation in *Chicoreus artemis. Hawaiian Shell News* 27(3):16, textfigs.

D'ATTILIO, A., and B. W. MYERS
1984 Descriptions of five new muricacean gastropods and comments on two additional species, in the families Muricidae and Coralliophilidae: Mollusca. *Trans.San Diego Soc.Nat.Hist.* 20(5):81-94, figs.1-34.

FAIR, R. H.
1976 *The Murex book: an illustrated catalogue of Recent Muricidae (Muricinae, Muricopsinae, Ocenebrinae).* Honolulu. 138p., 23pls.

GARDNER, J. A., and T. H. ALDRICH
1919 Mollusca from the Upper Miocene of South Carolina with descriptions of new species. *Proc.Acad.Nat.Sci.Philadelphia* 71:17-53, pls. 1-4.

GRASSÉ, P.
1968 *Traite de Zoologie. Anatomie, systématique, Biologie.* Paris 5:1-1083, textfigs.

GRAY, J. E.
1847 List of the genera of Recent Mollusca, their synonyma and types. *Proc.Zool.Soc.London.* Pt.15:129-219.

HIROHITO, EMPEROR OF JAPAN
1983 *Hydroids from Izu Ôshima and Niijima.* Biol.Lab.Imp.Household, Tokyo. 83p., textfigs.

HOUART, R.
1981 On the identity of 3 related muricids. *Hawaiian Shell News* 29(6):7, textfigs.
1983a *C.artemis – rossiteri – nobilis. Hawaiian Shell News* 31(7):10, textfigs.
1983b Three new tropical Muricacean species (Gastropoda:Muricidae). *Venus:Jap.J.Malac.* 42(1):26-33, pl.1. textfigs.

HUBBARD, M. D.
1973 Comments on Vokes' paper. *Veliger* 15(4):360-361.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE
1961 *International Code of zoological Nomenclature adopted by the XV International Congress of zoology.* London 176p.

KEEN, M.
1971 *Sea shells of tropical West America. Marine mollusks from Baja California to Peru. Second edition.* Stanford. 1064p., 22pls.

KIENER, L. C.
1835-36 *Spécies général et iconographie des coquilles vivantes. Famille des Purpurifères. Genre Pourpre.* Brest 8:1-151, pls. 1-46.
1842 *Spécies général et iconographie des coquilles vivantes. Famille des Canalifères. Genre Rocher (Murex Lin.).* Paris 7:1-131, pls. 1-47 (Plates 1842; text 1843).

LAMARCK, J. B. P. A. de M. de
1816 *Tableau Encyclopedique et méthodique des trois régnes de la nature.* Paris pp.1-16, pls. 391-488.
1822 *Histoire naturelle des animaux sans vertèbres. Mollusques.* Paris 7:1-711.

MACNEIL, F. S., and D. T. DOCKERY III
1984 Lower Oligocene Gastropoda, Scaphopoda and Cephalopoda of the Vicksburg group in Mississippi. *Bull.Mississippi Dept.Nat.Res.Bur.Geol.* 124:1-415, pls. 1-72.

MAES, V. O.
1983 Observations on the systematics and biology of a turrid gastropod assemblage in the British Virgin Islands. *Bull.Mar.Sci.* 33(2):305-335, textfigs.

MCCRADY, J.
1859 Gymnophalmata of Charleston Harbour. *Proc.Elliott Soc. Nat.Hist. Charleston* 1:103-220, pls. 8-12.

MELVILL, J. C., and R. STANDEN
1899 Report on marine Mollusca obtained during the first expedition of Prof. A.C. Haddon to the Torres Straits, in 1888-89. *J.Linn. Soc. London Zool.* 27:150-206, pls. 10,11.

MÜHLHÄUSSER, H., and H. G. de COUET

1982 Beiträge zur Kenntnis der Arten *Chicoreus aculeatus* (Lamarck, 1822) und *Chicoreus rossiteri* (Crosse, 1872). *Spixiana* 5(1):35-45, textfigs.

NORDSIECK, F.

1972 *Die europäischen Meeresschnecken (Opistobranchia mit Pyramidellidae, Rissoacea).* Stuttgart 327 p., 41 pls., textfigs.

POWELL, A. W. B.

1942 The New Zealand Recent and fossil mollusca of the family Turridae. With general notes on turrid nomenclature and systematics. *Bull.Auckland Inst.Mus.* No.2:1-192, pls.1-14, textfigs.

1966 The molluscan families Speightiidae and Turridae. An evaluation of the valid taxa, both Recent and fossil, with list of characteristic species. *Bull.Auckland Inst.Mus.* No.5:1-184, pls.1-23, texfigs.

1979 *New Zealand Mollusca. Marine, Land and freshwater shells.* Auckland 500p., 82pls., textfigs.

RADWIN, G. E., and A. D'ATTILIO

1976 *Murex shells of the world. An illustrated Guide to the Muricidae.* Stanford. 284p., 32 pls., textfigs.

REEVE, L.

1845-49 *Conchologia Iconica. Monograph of the genus Murex.* London 3:pls. 1-36 (1845-46); Suppl.pl.1 (1849).

REHDER, H.

1980 The marine mollusks of Easter Island (Isla de Pascua) and Sala y Gomez. *Smithsonian Contrib.Zool.* No.289:1-167, pls, 1-14.

ROSEWATER, J.

1975 An annotated list of the marine molluscs of Ascension Island, South Atlantic Ocean. *Smithsonian Contrib.Zool.* No.189:1-41, textfigs.

SHIKAMA, T.

1977 Descriptions of new and noteworthy Gastropoda from Western Pacific and Indian Oceans. *Sci.Repts.Yokohama Nat.Univ.* Sect.2, No.24:9-23, pls.1-5, textfigs.

THIELE, J.

1925 *Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898-1899.* Jena 17(2):1-348, pls. 1-34.

VOKES, E. H.

1970 Some comments on Cernohorsky's "Muricidae of Fiji". *Veliger* 13(2):182-187.

1971 Catalogue of the genus *Murex* Linné (Mollusca: Gastropoda); Muricinae, Ocenebrinae. *Bull.Americ.Paleont.* 61(268):5-141.

1972 Note on Secondary Homonymy. *Veliger* 15(2):102.

WENZ, W.

1938 *Handbuch der Paläozoologie.* Berlin 6(1):1-948, textfigs.

SUBFOSSIL BONES OF A LARGE SKINK (REPTILIA: LACERTILIA) FROM MOTUTAPU ISLAND, NEW ZEALAND

B. J. GILL

AUCKLAND INSTITUTE AND MUSEUM

Abstract. Subfossil lizard bones from Motutapu Island (Auckland) are illustrated and discussed. They came from beneath the Rangitoto ash layer and are therefore at least 600 years old. The bones are from a skink *ca.* 155 mm from snout to vent, which is larger than reported for any living New Zealand specimen.

Several writers have briefly mentioned the occurence in New Zealand of subfossil lizard bones (for example Yaldwyn 1958, Bull & Whitaker 1975: 246, Millener & Templer 1981 and Newman 1982: 142, 395) but few finds have been described or discussed in detail. This paper illustrates some bones of a skink recently collected on Motutapu Island near Auckland and reviews some of the gross osteological differences between the New Zealand skinks (*Leiolopisma, Cyclodina*) and geckos (*Hoplodactylus, Naultinus*).

In 1982, excavations at the "Sunde" archaeological site (N38/24; West Point, Motutapu Island) directed by R.K. Nichol uncovered bones of three large, at least five medium-sized and several small lizards. This paper discusses only a well preserved group of the larger bones (Auckland Museum H880) collected together in excavation unit Ebl and almost certainly belonging to one individual. The group comprises left and right maxillae, dentaries, scapulocoracoids and humeri, the fused parietals, the fused occipital elements, the right pterygoid and nine presacral vertebrae. The evidence for the other lizards rests on a small assortment of bones, some broken, which are not discussed further.

The "Sunde" site is of a seasonal Polynesian encampment which was occupied before and after the Rangitoto eruption of *ca.* A.D. 1400. The lizard bones were recovered from midden deposits beneath the Rangitoto ash and are therefore at least 600 years old, and probably not much older (R.K. Nichol pers. comm.). Bones of the tuatara (*Sphenodon punctatus)* and of many species of birds occur in the same strata (Scott 1970). The camp is believed to be one to which shellfish, fish and birds collected in the immediate vicinity were brought for processing and export, with some local consumption. The larger lizards also may have been caught on the island for consumption. However, it is equally possible that they may have lived or foraged in the midden and died there without having been eaten — the most likely explanation for the presence of the smaller animals.

Rec. Auckland Inst. Mus. 22: 69-76 18 December 1985

The Auckland Museum registration numbers of the bones illustrated in this paper are as follows: subfossil (H880), *Leiolopisma suteri* (H675), *Cyclodina whitakeri* (H836), *Cyclodina oliveri* (H883), *Naultinus* (= *Heteropholis*) *stellatus* (H840) and *Hoplodactylus pacificus* (H676).

IDENTITY OF THE BONES

Apart from the work of Stephenson & Stephenson (1956) on geckos, the osteology of New Zealand lizards is virtually unstudied. In particular it is not known how the genus *Cyclodina,* resurrected by Hardy (1977), differs osteologically from the other New Zealand skinks (*Leiolopisma*). It was not the aim of the present study to compare in detail the genera and species of New Zealand skinks, but to illustrate a selection of the bones from Motutapu in order to demonstrate that they are from a skink and not a gecko. Cursory examination of some 20 sets of bones of New Zealand lizards in the Auckland Museum collection suggests that, as far as the gross morphology of the following elements is concerned, the differences between geckos and skinks outlined here apply to all the New Zealand genera.

Maxillae

The maxilla of geckos (Fig. 1) has a deep anterior notch and a single posterior process, whereas in skinks (Fig. 2) there is no deep notch and there are two posterior processes. On these grounds the subfossil maxillae (Fig. 3) are clearly those of a skink.

Dentaries

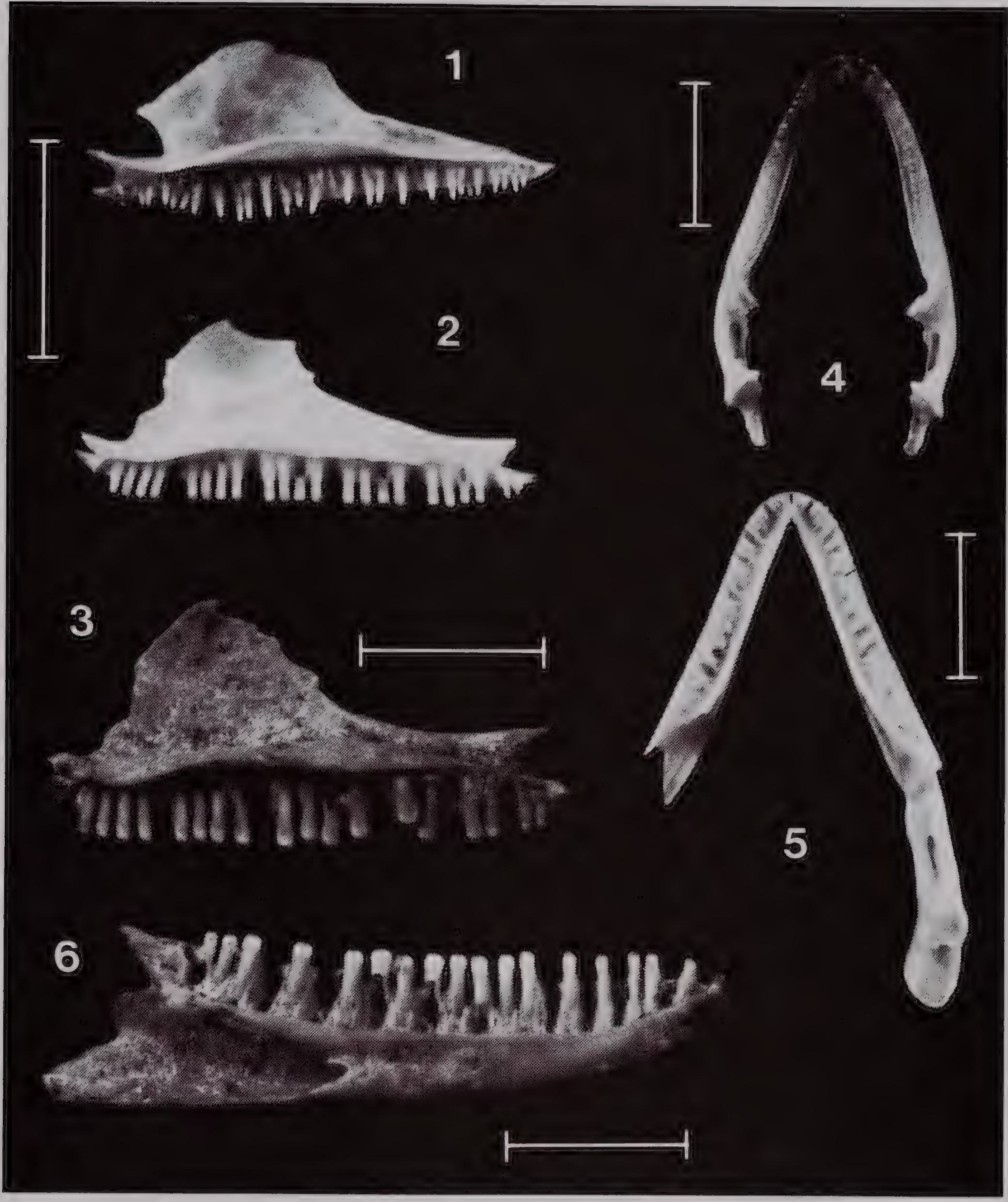
The dentaries of a gecko viewed from above (Fig. 4) are more curved than those of a skink (Fig. 5). The subfossil dentaries lack a strong curve, and in the lateral plane they widen greatly at the proximal end (Fig. 6). Gecko dentaries widen much less proximally.

Parietals

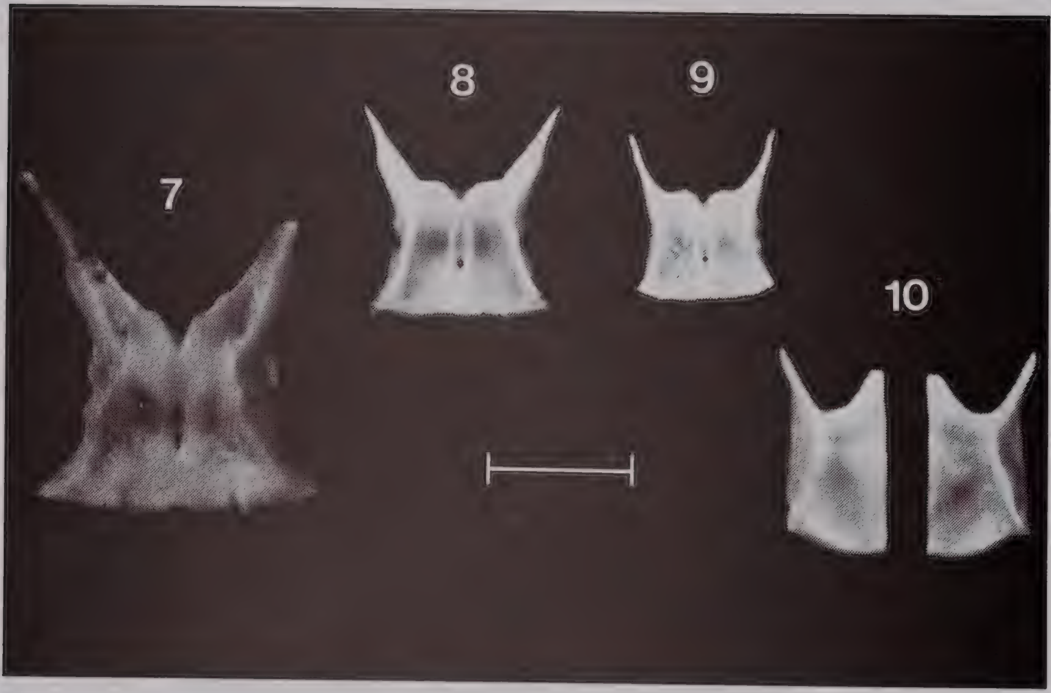
The parietals of the subfossil (Fig. 7) and other skinks (Figs. 8, 9) are fused and pierced by a parietal (= pineal) foramen. This is the condition in lygosomine skinks according to Greer (1970), whereas in geckos (Stephenson & Stephenson 1956), the parietals remain separate and there is no foramen (Fig. 10).

Occipital Elements

On the fused occipital elements ("brain cases") of skinks (Figs. 11, 12) and the subfossil (Fig. 13) the pair of club-shaped anterior processes of the basisphenoid bone form an acute angle. In geckos (Fig. 14), the angle is obtuse and the brain case in many other ways looks unlike those of the skinks. The occipital elements are said to be not fused at all in *Naultinus* (Stephenson & Stephenson 1956).



Figs. 1-6. 1-3. Right maxillae (internal surfaces, anterior to left). 1. *Hoplodactylus pacificus*. 2. *Cyclodina oliveri*. 3. Subfossil. 4-5. Lower jaws (view from above). 4. *Naultinus stellatus*. 5. *C. whitakeri*. 6. Subfossil, left dentary (internal surface). Scale line = 5 mm.



Figs. 7-10. Parietals (internal surfaces, anterior to bottom). 7. Subfossil. 8. *Cyclodina whitakeri*. 9. *Leiolopisma suteri*. 10. *Hoplodactylus pacificus*. Scale line = 5 mm.

Scapulocoracoids

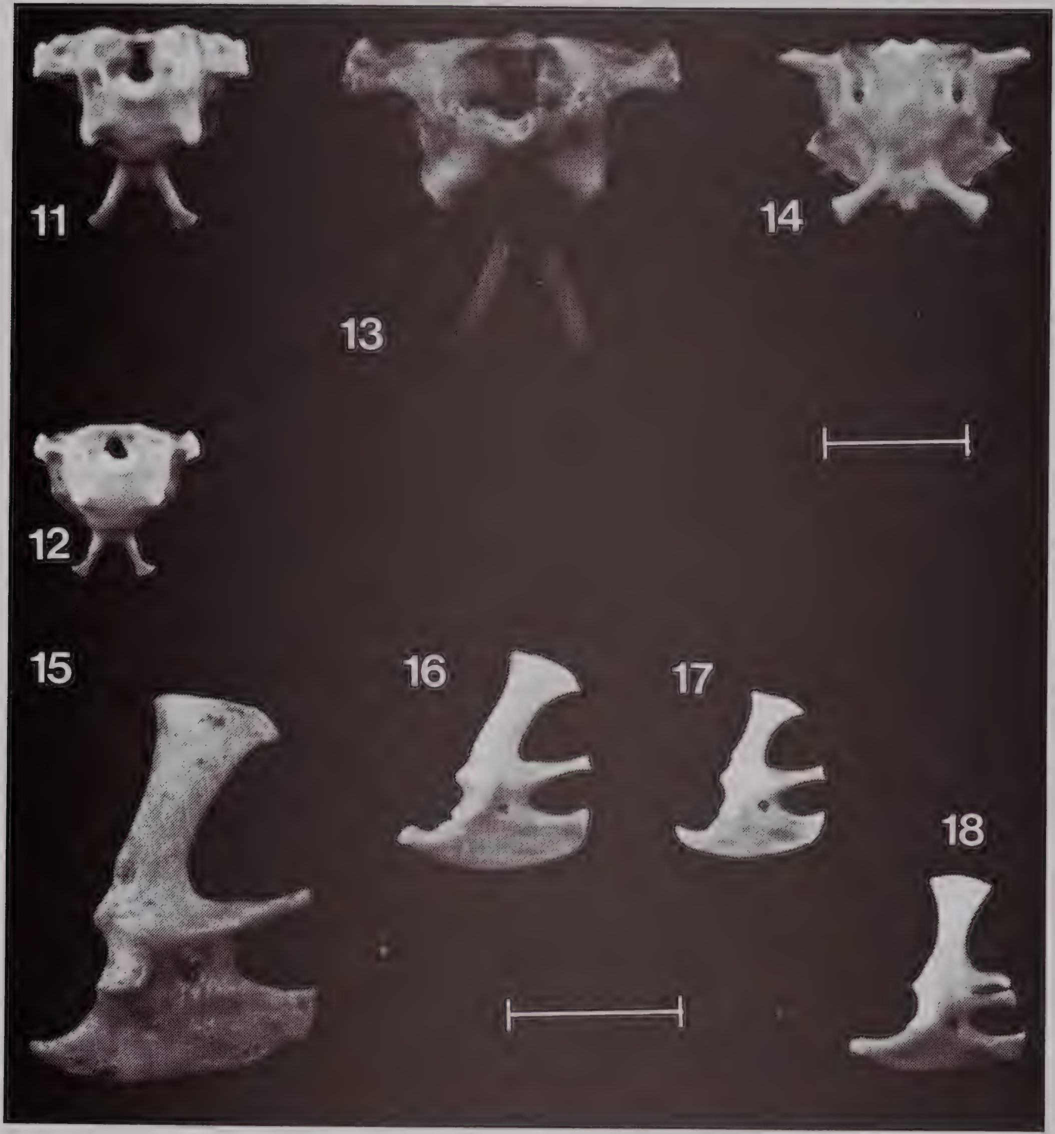
The scapulocoracoids ("shoulder girdle" elements) of the subfossil (Fig. 15) are similar to those of skinks (Figs. 16, 17). In geckos, the angles are different and there is an extra process (Fig. 18).

Vertebrae

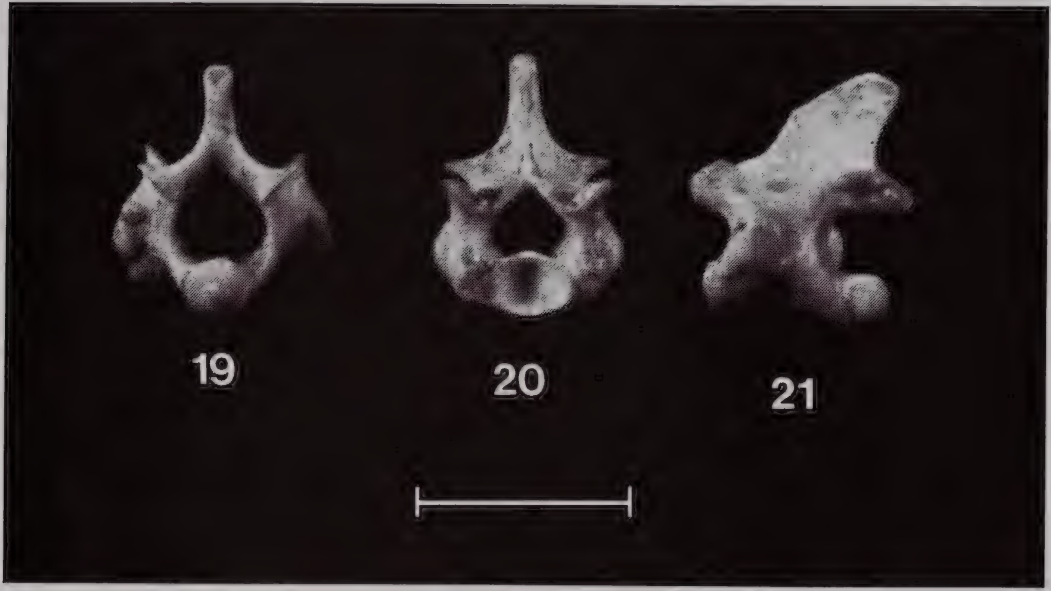
The presacral vertebrae of the subfossil (Figs. 19-21) are procoelous (the centrum is concave in front and convex behind) and have solid centra. Most reptiles have procoelous vertebrae (Young 1950), but the vertebrae of New Zealand geckos (Stephenson & Stephenson 1956) are amphicoelous (the centrum is concave at both ends). Also, the centrum in geckos is pierced by a large central foramen not present in the New Zealand skink material I have examined.

SIZE

I measured alizarin transparencies of nine contemporary skinks (1 *Leiolopisma suteri*, 6 *L. smithi* and 2 *Cyclodina ornata*) with snout-vent (SV) lengths of 56-74 mm. The average ratio of right humerus length divided by SV length was 0.101 (range = 0.0897-0.112, standard deviation = 0.0065). The right humerus of the subfossil is 15.7 mm long, so by simple proportion the SV length of this animal must have been *ca.* 155 mm (140-175 mm using the range of ratios for the contemporary specimens).



Figs. 11-18. 11-14. Occipital elements (external surfaces, anterior to bottom). 11. *Cyclodina whitakeri.* 12. *Leiolopisma suteri.* 13. Subfossil. 14. *Hoplodactylus pacificus.* 15-18. Right scapulocoracoids (external surfaces, anterior to right). 15. Subfossil. 16. *C. whitakeri.* 17. *L. suteri.* 18. *H. pacificus.* Scale line = 5 mm.



Figs. 19-21. Subfossil. Three presacral vertebrae. 19. Posterior surface. 20. Anterior surface. 21. Lateral surface, anterior to left. Scale line = 5 mm.

Discussion

The largest skink occurring on Motutapu I today is *Leiolopisma suteri* which rarely exceeds 85 mm SV on the island (Towns 1975). However, the large skinks currently restricted to predator-free offshore islands are generally believed to have relict distributions and could once have occurred naturally on Motutapu. The subfossil skink may prove to be conspecific with any of the larger extant New Zealand species.

The three biggest contemporary New Zealand skinks are *Leiolopisma homalonotum* which reaches 143 mm SV (J.A. West pers. comm.) and is endemic to Great Barrier I, *L. fallai* which reaches 140 mm SV (Hardy 1977) and is endemic to the Three Kings Is, and *Cyclodina alani* which reaches 142 mm SV (I.C. Southey pers. comm.) and is known from only a few northern offshore islands. The subfossil skink at 140-175 mm SV, is therefore larger than any contemporary New Zealand specimen, or at least as large as the biggest on record. However, it is possible that some of our existing species produced larger individuals, than are seen today, when they existed in larger populations over wider areas.

Though large by New Zealand standards the subfossil skink is much smaller than many representatives of the family overseas. Even within *Leiolopisma* the largest living species (*L. telfairii,* extant on Round Island off Mauritius and extinct on Mauritius and Réunion) reaches at least 171 mm SV, and a species known from subfossils from Mauritius (*L. mauritiana*) probably reached 340 mm SV (Arnold 1980).

Although kiore (*Rattus exulans*) have occurred in New Zealand for at least 900 years (Gibb & Flux 1973) some inshore islands (such as Mana I near Wellington) escaped colonisation (Atkinson 1978). No kiore bones have been found at the "Sunde" site in the deposits beneath the Rangitoto ash (R.K. Nichol pers. comm.) so Motutapu I may have been free of kiore 600 years ago, which may help to explain the presence of such a large lizard.

Acknowledgements. I thank Reg Nichol for the opportunity to study the subfossil bones, J. Robb for the loan of alizarin transparencies of New Zealand skinks and Tony Whitaker for helpful comments on the manuscript.

REFERENCES

ARNOLD, E. N.
1980 Recently extinct reptile populations from Mauritius and Réunion, Indian Ocean. *J. Zool., London* 191:33-47.

ATKINSON, I. A. E.
1978 Evidence for effects of rodents on the vertebrate wildlife of New Zealand islands. *In* P.R. Dingwall, I.A.E. Atkinson and C. Hay (eds.). *The ecology and control of rodents in New Zealand nature reserves.* Dept. Lands Survey Info. Ser. No.4. 237p.

BULL, P. C., and A. H. WHITAKER
1975 The amphibians, reptiles, birds and mammals. *In* G. Kuschel (ed.). *Biogeography and ecology in New Zealand.* The Hague, Junk. 689p.

GIBB, J. A., and J. E. C. FLUX
1973 Mammals. *In* G.R. Williams (ed.). *The natural history of New Zealand.* Wellington, Reed. 434p.

GREER, A. E.
1970 A subfamilial classification of scincid lizards. *Bull. Mus. Comp. Zool.* 139:151-183.

HARDY, G. S.
1977 The New Zealand Scincidae (Reptilia: Lacertilia); a taxonomic and zoogeographic study. *N.Z.J. Zool.* 4:221-325.

MILLENER, P. R., and C. J. TEMPLER
1981 The subfossil deposits of Paryphanta (Mac's Quarry) Cave, Waitomo. *J. R.Soc. N.Z.* 11:157-166.

NEWMAN, D. G. (Ed.)
1982 New Zealand herpetology. *N.Z. Wildlife Serv. Occ. Publ.* No.2:1-495.

SCOTT, S. D.
1970 Excavations at the "Sunde Site", N38/24, Motutapu Island, New Zealand. *Rec. Auckland Inst. Mus.* 7:13-30.

STEPHENSON, N. G., and E. M. STEPHENSON
1956 The osteology of the New Zealand geckos and its bearing on their morphological status. *Trans. R.Soc. N.Z.* 84: 341-358.

TOWNS, D. R.
1975 Reproduction and growth of the black shore skink, *Leiolopisma suteri* (Lacertilia: Scincidae), in north-eastern New Zealand. *N.Z.J. Zool.* 2: 409-423.

YALDWYN, J. C.
1958 Notes on the environment and age of the sub-fossil deposits of the Martinborough caves. *Rec. Dominion Mus.* 3: 129-135.

YOUNG, J. Z.
1950 *The life of vertebrates.* London, Oxford University Press. 767p.

A NEW GENUS AND SPECIES OF PROSYMPIESTINAE (HEXAPODA : HEMIPTERA : ARADIDAE) FROM NORTHLAND, NEW ZEALAND

M. Kirman

UNIVERSITY OF WAIKATO, HAMILTON

Abstract. Mesadenocoris robustus gen. et sp.n. from the Whangaroa and Hokianga districts of Northland, New Zealand, is described and figured. This new genus of Prosympiestinae shares some features with *Adenocoris* Usinger and Matsuda, particularly the spiny antenniferous tubercles, and with *Neadenocoris* Usinger and Matsuda, particularly in the anterior projection of the anterior angles of the pronotum. A key to the genera of the New Zealand Prosympiestinae is included.

The subfamily Prosympiestinae is known only from Australia, Tasmania, New Guinea, New Zealand, and Chile, although the systematic position of the Chilean genus *Llaimacoris* Kormilev has been questioned by Pendergrast (1969), and yet awaits resolution. The previously known New Zealand prosympiestine genera were *Adenocoris* Usinger & Matsuda, 1959 and *Neadenocoris* Usinger & Matsuda, 1959. This new genus shows an interesting admixture of features of both these genera.

Specimens of this new genus in the Prosympiestinae were encountered while determining aradids in the collections of the Auckland Institute and Museum (AMNZ) and the Canterbury Museum (CMNZ).

Family ARADIDAE
Subfamily PROSYMPIESTINAE (Usinger & Matsuda 1959)

KEY TO THE GENERA OF NEW ZEALAND PROSYMPIESTINAE

1 Antennae inserted on cylindrical tubercles .... **Neadenocoris** U. & M.
Antennae inserted on anteriorly directed spine-like tubercles 2

2 Pronotum with anterolateral angles subacutely produced anteriorly, lateral margins convex. Third antennal segment shorter than first segment .... **Mesadenocoris** gen.n.
Pronotum with anterolateral margins broadly rounded or weakly produced anteriorly, lateral margins angularly produced laterally. Third antennal segment longer than first segment .... **Adenocoris** U.& M.

Rec. Auckland Inst. Mus. 22: 77-83 18 December 1985

Genus **Mesadenocoris** gen.nov.

Brachypterous. Body surface punctate, with short curved hairs.

Head longer than broad across eyes. Clypeus large with juga prominent on either side at basal two-thirds. Rostrum arising from anteroventrally opened buccal cavity, well back of apex of clypeus, extending just beyond ventral margin of head. Underside of head without rostral groove. Eyes projecting laterally, substylate. Postocular lateral margins abruptly narrowed to a neck-like constriction, then widening before insertion into collar. Antennae evenly clothed with long erect pilosity throughout, inserted on prominent tubercles anterior to eyes, first antennal segment stout, exceeding apex of head by more than half its length; second segment subequal to first; third segment shortest, pedunculate; fourth segment longest, pedunculate. Antenniferous tubercles subacutely produced anteriorly.

Pronotum narrowed, collar-like at anterior margin; anterolateral angles subacute, produced anteriorly; lateral margins convex; posterior margin slightly concave; both lateral and posterior margins bordered with rim-like carina; disc depressed but with median longitudinal elevation with large elongate elevated tubercles at either side. Scutellum plate-like, wider than long, not triangular, broad posterior lobe extending to posterior margin of first abdominal segment. Hemelytra reaching almost to level of apex of scutellum.

Abdomen with lateral margins roundly dilated at middle. First and second abdominal segments clearly separated, the latter strongly elevated medially. Abdominal disc moderately elevated medially; dorsal scent-gland openings large, double, displaced posteriorly but equally developed and spaced. Pattern of glabrous areas distinct, conforming to the 2:1:1 type of Usinger & Matsuda (1959). Connexival plates strongly reflexed, subquadrate in abdominal segments II-VI. Spiracles (both sexes), segment I = ventral, II to VII = sublateral, VIII = ventral.

Undersurface convex, coarsely punctured. Prosternum not elevated, plate-like between front coxae. Meso- and metasterna separated by a distinct suture, metasternum much longer than mesosternum. Metapleural scent-gland opening between mid and hind coxae, with prominent bristle emerging from ostiole, with a much convoluted evaporating area occupying a considerable part of the metapleuron, leading to a deep evaporating channel extending to the lateral margin. Pattern of glabrous areas conforming to the 2:2:1 type of Usinger & Matsuda (1959).

Eighth abdominal segment in male well developed as a cup-like plate beneath genital segment; no projections or lobes on either side of genital segment. Eighth segment in female complete above, not produced on either side of median lobe.

Legs evenly clothed with coarse erect pilosity but with distinct glabrous trochanters, femora robust, pretarsi with long setose parempaodia, pulvilli with distipulvilli as small triangular pads (Goel & Schaefer 1969).

TYPE SPECIES. *Mesadenocoris robustus* sp.n.

Derivation. Mes(o), Gk = middle, + *Adenocoris*.

1

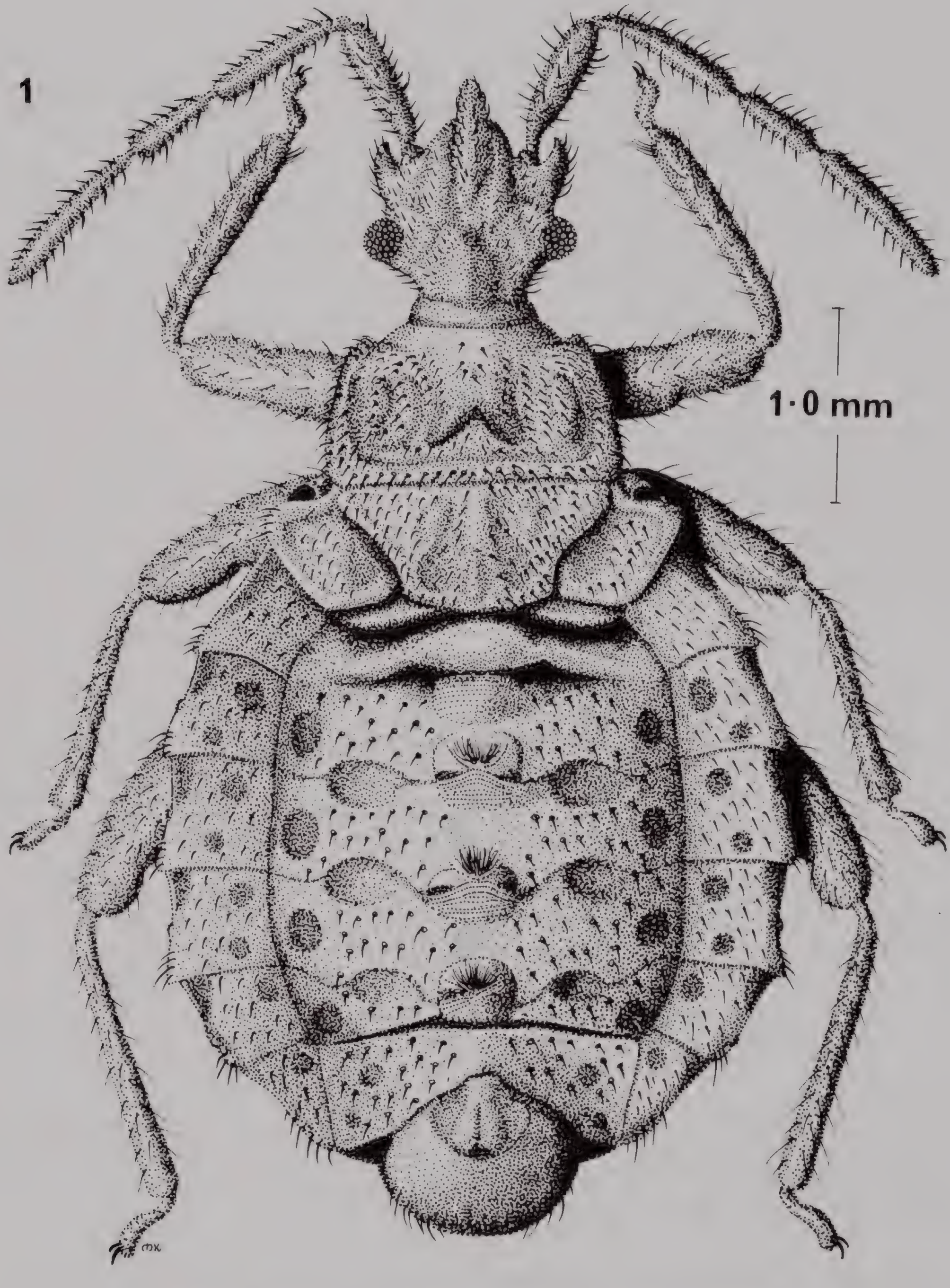


Fig. 1. *Mesadenocoris robustus,* male holotype. Dorsal.

Mesadenocoris robustus sp.n. (Figs. 1-9)

Head. Longer than broad across eyes (male 1.25 : 1.00 mm, female 1.52 : 1.15 mm). Clypeus large, posteriorly reaching level of anterior margin of eyes, apex surpassing basal half of first antennal segment. Juga prominent on lateral margins, reaching beyond middle of clypeus. Antenniferous tubercles slender, subacute, slightly convergent anteriorly. Postocular lateral margins abruptly narrowed posteriorly to a neck-like constriction, then widening before insertion into collar. Antennae evenly clothed with long erect pilosity throughout; proportional length of 1st to 4th segments: male 0.73 : 0.78 : 0.50 : 0.88 mm; female 0.83 : 0.85 : 0.60 mm (4th segment lacking); subequal in thickness throughout, first segment a little thicker than the rest. Upper surface of head with median elevation behind clypeus. Rostrum with first segment shortest not exceeding buccal pit, second segment short, third longer, fourth longest just reaching beyond ventral margin of head, proportional lengths of 2nd to 4th rostral segments, male; 0.20 : 0.32 : 0.50 mm; female; 0.22 : 0.35 : 0.54 mm.

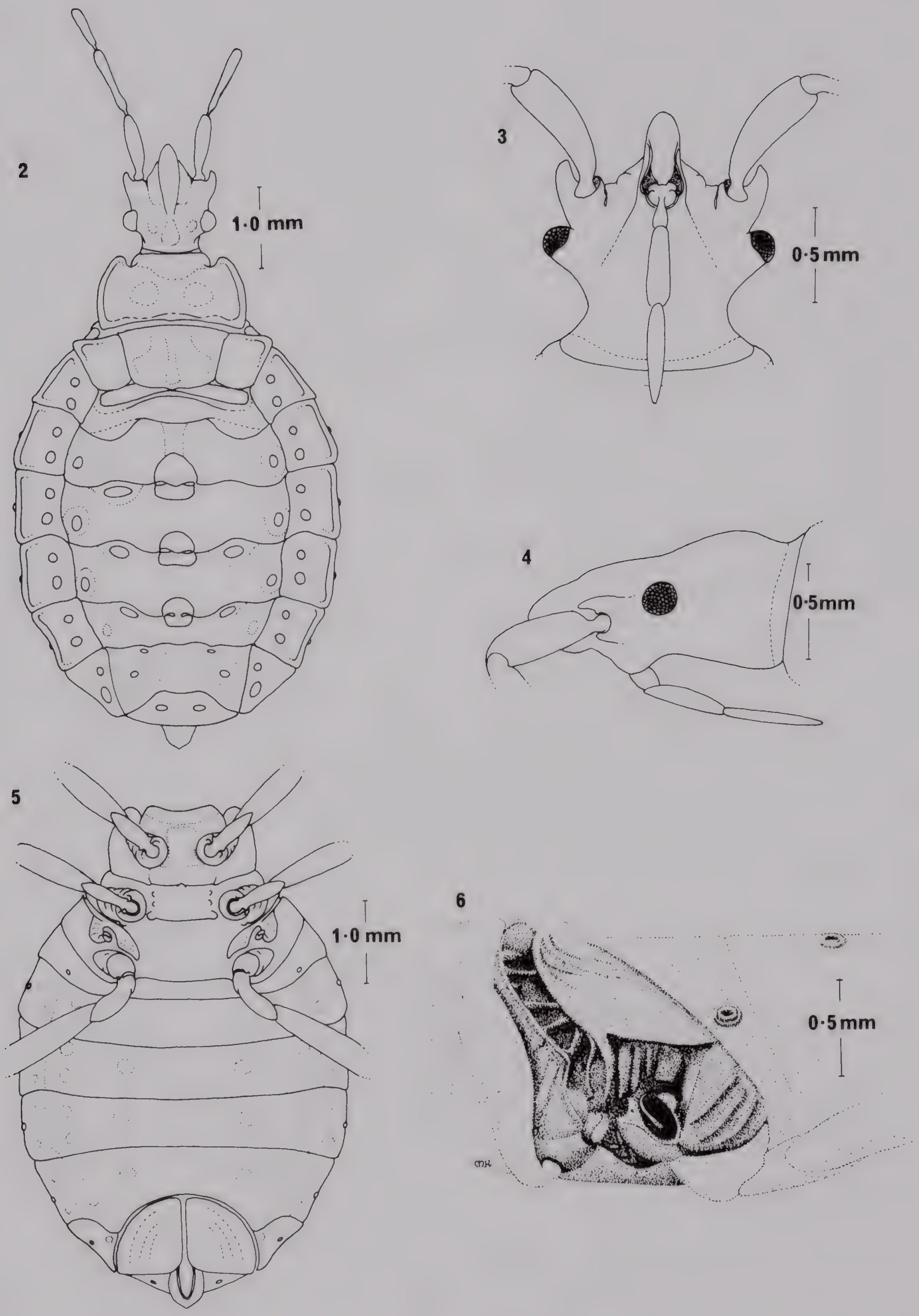
Thorax. Pronotum twice as wide at base as long at middle (male 1.40 : 0.70 mm, female 1.80 : 0.88 mm), collar not distinct, anterolateral angles acute, produced anteriorly (more strongly in the female); lateral margins convex, carinate; posterior angles subrectangular; posterior margin carinate, straight in male, slightly anteriorly curved in female. Disc strongly punctate with short curved hairs (longer hairs on margins), medial and lateral callosities separated by oblique depression. Metasternal scent-gland channel opening clearly visible dorsally anterior to anterior margin of hemelytra.

Scutellum slightly shorter than pronotum at middle (male 0.60 : 0.70 mm, female 0.85 : 0.88 mm); posterior margin broadly rounded; lateral margin broadly sinuate in male almost reaching posterolateral angle of pronotum, in female straight for basal 5/6ths, running obliquely to near posterolateral angles of pronotum, then turning laterally towards angles. Disc punctate, depressed, with lateral callosities separated by median elevation.

Hemelytra reaching almost to level of apex of scutellum; anterior, lateral and posterior margins carinate; anterolateral angles acute, broadly rounded; posterolateral angles obtuse, broadly rounded; upper surface moderately punctured.

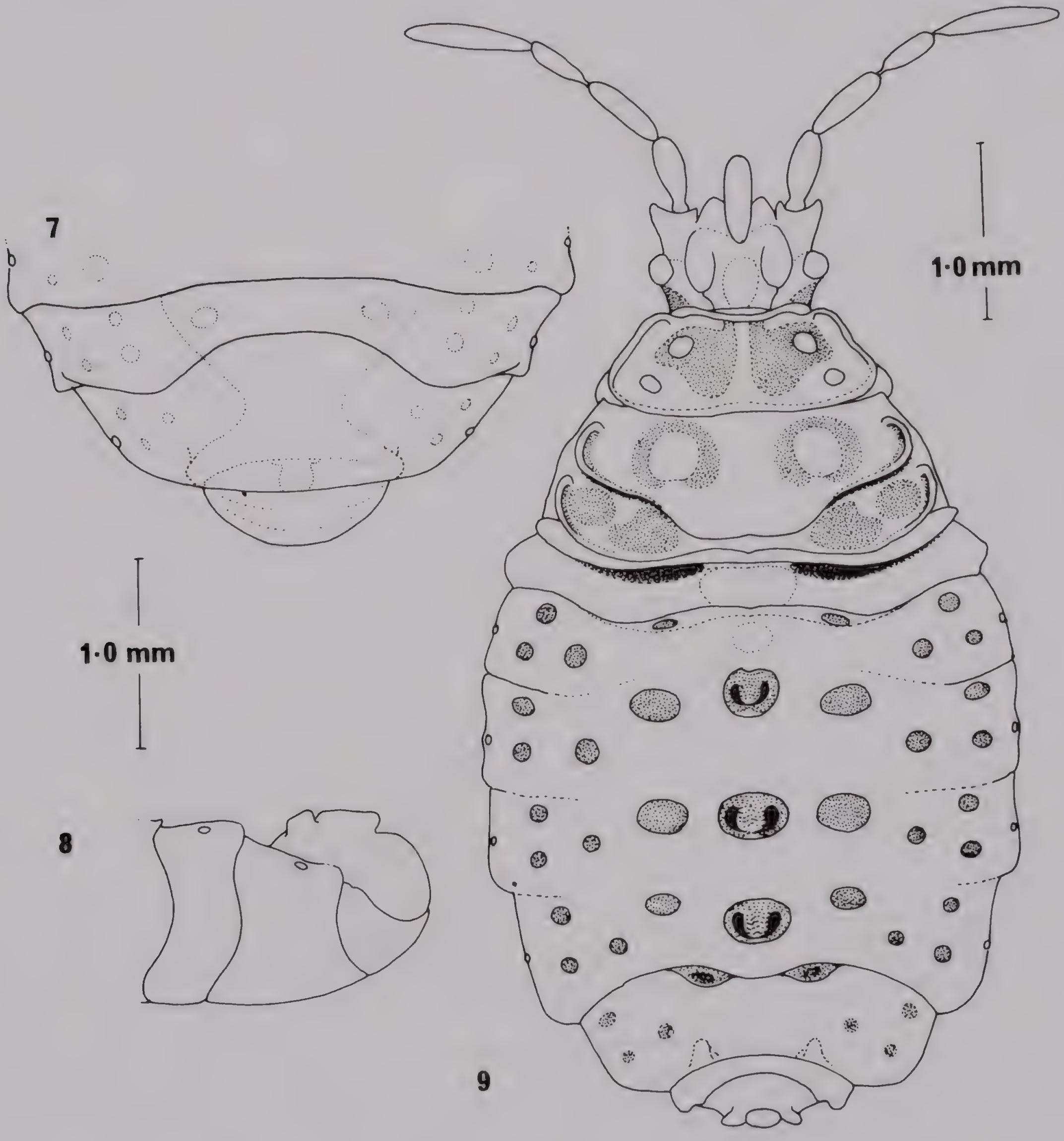
Abdomen. Roundly dilated at middle, connexivum reflexed. Proportional widths of 2nd to 6th abdominal segments: Male 2.80 : 3.16 : 3.22 : 3.09 : 2.42 mm; female 3.50 : 4.00 : 3.95 : 3. 75 : 2.90 mm; first dorsal abdominal segment medially obscured by posterior lobe of scutellum; second segment sinuate strongly medianly elevated; dorsal scent-glands distinct, elevated, openings paired, located near anterior margins of fourth, fifth and sixth dorsal abdominal segments; sublateral tergal markings located in the anterior part of each segment; lateral tergal markings located along lateral margins in posterior part of each segment.

Seventh tergal abdominal segment in male moderately elevated medially, essentially trapezoidal but with posterior margin incised anteriorly forming an inverted V-shaped notch accommodating ninth segment, ventrally *ca.* 2 1/2 x longer at middle than sixth segment (0.80 : 0.30 mm), seventh connexival segment subtriangular. Eighth segment crescentic cup-like plate beneath genital segment not visible dorsally. Ninth segment globose, strongly elevated dorsally.



Figs. 2-6. *Mesadenocoris robustus,* female allotype. 2. Dorsal. 3. Head, ventral. 4. Head, lateral. 5. Ventral. 6. Metasternal scent-gland, lateral.

Seventh tergal abdominal segment in female medially slightly elevated, essentially trapezoidal, anterior margin bisinuate, lateral margins slightly convex, posterior margin concave bisinuate; ventrally a bilobed plate *ca.* 1 1/3 x as long as preceding segment at middle, each lobe slightly obliquely carinate, seventh connexival segment subtriangular. Eighth segment conspicuously exposed across its full width above, posterior margin rounded posteriorly, ventrally exposed as subtriangular plate at either side of ninth segment, bearing spiracle near posterior margin. Ninth segment with apex obtusely pointed.



Figs. 7-9. *Mesadenocoris robustus*. 7,8 Male holotype. 7. Terminalia, ventral, 8. Terminalia, lateral. 9. Nymph. Dorsal.

Colour. Red-brown overall, both sexes.

Measurements. Length; male 5.50 mm; female 7.87 mm. Maximum width; male 3.22 mm; female 4.00 mm.

Nymph. Pattern of dorsal abdominal scent-gland openings and glabrous areas typical for Prosympiestinae (Fig. 9).

Specimens Examined. Holotype male, leaf litter, *ca.* 8 km (5 miles) east of Kaeo, Nth.Auckland, 18.XII.1963. P.M. Johns (CMNZ). Allotype female, Waimatenui, 10.X.1932. C.E.Clarke collection (AMNZ). Nymph, same data as holotype (CMNZ).

Mesadenocoris is closely related to *Adenocoris* and *Neadenocoris,* exhibiting several important features of both genera, to the extent of seeming to be an intermediate form. *Adenocoris* features shared include large size (maximum length within *Neadenocoris* sp. < 4.6 mm), spiny antenniferous tubercles and mesothoracic scent-gland with very large evaporating area and connecting channel. *Neadenocoris* features shared include rostrum length, just exceeding anterior margin of prosternum, rather than extending to between front coxae; prothorax with lateral margins straight or nearly so, and anterior projection of the anterolateral angles; and abdomen rounded, resembling *N.ovatus* Usinger & Matsuda and *N.spinicornis* Usinger & Matsuda. The distinctive *Mesadenocoris* feature is the third antennal segment being markedly shorter than other segments.

The species is named for its robust appearance (Lat., robustus).

Acknowledgements. I should like to thank Mr K.A.J. Wise, of the Auckland Institute and Museum, and the Director, Canterbury Museum, Christchurch, for the loan of specimens. Thanks are also due to Dr C.E. Lee, National University, Taegu, Korea for his preliminary work on this new genus and species, and to Professor J.G. Pendergrast, Waikato University, Hamilton, for reading and discussing the manuscript.

REFERENCES

GOEL, S. C., and C. W. SCHAEFER
1969 The structure of the pulvillus and its taxonomic value in the land Heteroptera (Hemiptera). *Ann. Ent. Soc. Am.* 63(1): 307-312.

PENDERGRAST, J. G.
1969 The systematic position of *Llaimacoris* Kormilev, 1964. (Hemiptera : Aradidae). *Ent. Mon. Mag.* 105: 172-174.

USINGER, R. L., and R. MATSUDA
1959 Classification of the Aradidae, (Hemiptera : Heteroptera). London, British Museum (Natural History). 410p.

SUCCESSFUL ESTABLISHMENT OF THE ASIAN MUSSEL *Musculista senhousia* (BENSON IN CANTOR, 1842) IN NEW ZEALAND

R. C. WILLAN

UNIVERSITY OF QUEENSLAND, BRISBANE, AUSTRALIA.

Abstract. The Asian marine mussel *Musculista senhousia* (Benson in Cantor) was accidentally introduced to New Zealand in the 1970s and by 1984 it had become well established in the Auckland Harbour area (Waitemata Harbour, Tamaki Estuary and Tamaki Strait). *M. senhousia* has also entered, and established in, ports of California and (recently) Western Australia. Shipping, rather than natural larval dispersal, appears to be the most probable agent of first introduction of four foreign bivalves into New Zealand within the last decade – *Theora lubrica* Gould, *Limaria orientalis* (A. Adams & Reeve), *Crassostrea gigas* (Thunberg), *Musculista senhousia* (Benson in Cantor). Once introduced, all four species spread rapidly. Concern is expressed at the ability of *M. senhousia* to form dense monospecific mats, so thick they dramatically alter the biota.

While in Auckland late in 1984, I visited Motukaraka Island in Tamaki Strait, where the intertidal biota is well known to me. I have visited there regularly between 1964 and 1980, and sampled there fortnightly from 1976 to 1979. Unexpectedly a species of mussel was found which had never been seen there previously. Subsequent visits to other beaches revealed this mussel was widespread and common throughout Auckland's Tamaki Strait, Tamaki Estuary and Waitemata Harbour.

The mussel was identified as an Asian species, *Musculista senhousia* (Benson in Cantor, 1842). This identification was based on Benson's (1842) description, Reeve's (1857) illustration, accounts by Kira (1962a, 1962b) and B. Morton (1974), and examination of shells in the Auckland Institute and Museum. There is no mention of *M. senhousia* in Powell's (1979) authoritative manual of the New Zealand Mollusca or Hickman's (1983) extensive bibliography of New Zealand marine mussels (1880-1982). In the molluscan collections at Auckland Museum there are four lots of *Musculista senhousia;* all are from Japan and the shells in each lot match the New Zealand material perfectly. Data for the Japanese lots is as follows: Japan – Finlay Collection (AM 27986); Nishikurobe, Ise, Japan – Brookes Collection (AM 32252); Ise, Japan – Brookes collection (AM 32254); Tamioka, Tokyo Bay, Japan – Leg. Thaanum 1940 (AM 24478). Subsequently the identification of *M. senhousia* was confirmed by Dr B.R. Wilson of Melbourne. Voucher specimens of *M. senhousia* from New Zealand have been deposited in the Auckland Institute and Museum, Museum of Victoria Melbourne, Australian Museum Sydney, and Western Australia Museum Perth.

Rec. Auckland Inst. Mus. 22: 85-96 18 December 1985

Besides documenting the arrival of this exotic bivalve in New Zealand, this paper considers its taxonomy, biology and method of introduction.

Family MYTILIDAE

Genus **Musculista** Yamamoto & Habe, 1958

Musculista Yamamoto & Habe, 1958. Bull.Mar.Biol.Stn. Asamushi, Tohoku Univ.: 9. Type-species, by O.D., *Modiola senhousia* Benson in Cantor, 1842. Recent, western Pacific Ocean.

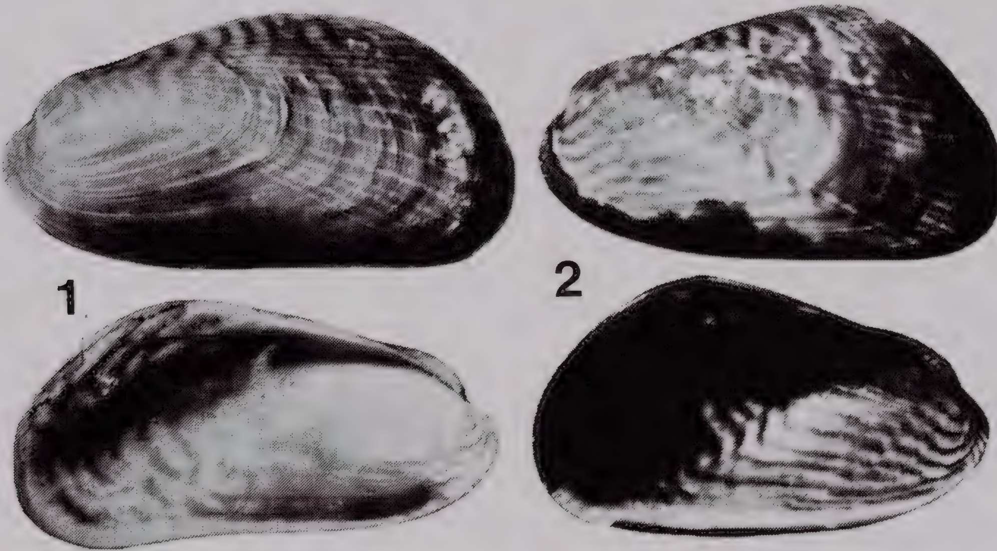
Musculista senhousia (Benson in Cantor, 1842) (Figs. 1-3)

1842.	*Modiola senhousia* Benson in Cantor, Ann. Mag. Nat. Hist. 9: 489.
1857.	*Modiola senhausii* (sic) Reeve, *Modiola* pl. 5, species 22.
1874.	*Modiola bellardiana* Tapparone-Canefri, Malac. Zool. "Magenta" 144, pl. 4, figs. 1b, 4, 4a.
1944.	*Volsella senhausi* (sic) (Reeve): A. G. Smith, Min. Coach. Club S. Calif. 39: 18.
1958.	*Musculus (Musculista) senhousia* (Benson in Cantor): Yamamoto & Habe, Bull. Mar. Biol. Stn. Asamushi, Tohoku Univ.: 9, pl. 2, fig. 13.
1959.	*Brachidontes (Arcuatula) senhousia* (Benson in Cantor): Kira, Col. Illus. Shells Japan: 114, pl. 45, figs 1a, 1b.
1962.	*Brachidontes (Musculista) senhousia* (Benson in Cantor): Kira, Col. Illus. Shells Japan: 114, pl. 45, figs 1a, 1b.
1966.	*Modiolus senhousei* (sic) (Benson in Cantor): Hanna, Occas. Pap. Calif. Acad. Sci. 48: 59, fig. 67.
1974.	*Musculista senhausia* (sic) (Benson in Cantor): B. Morton, Pacific Sci. 28: 19-33.

Benson (1842) in an addendum to Cantor's long paper on Chusan Island, originally spelt the specific name *"Senhousia"* and, although the spelling *senhousei* would strictly have been the correct patronym from the surname Senhouse, as Hanna (1966) noted, there is no evidence in the original publication a spelling mistake had occurred or that Benson intended the name should be written otherwise. Accordingly all subsequent combinations (i.e., *senhausi, senhausii, senhusi, senhousea, senhousei*) must be treated as incorrect subsequent spellings and therefore invalid (I.C.Z.N. 1961, Article 32 (a)). In fact the International Code specifically states that incorrect transliteration and improper latinisation are not to be considered inadvertent errors.

Musculista senhousia was originally placed in the genus *Modiola* but Benson (1842) did not provide an illustration to accompany his description. Reeve (1857), however, included an excellent coloured figure and commented: "An extremely delicate species, most beautifully sculptured and coloured." Yamamoto & Habe (1958) introduced the name *Musculista* (as a subgenus of *Musculus*) with *M. senhousia* as type-species. *Musculista* was differentiated by its thin shell with radially-ribbed antero-ventral section and smooth central and posterior sections. Kira (1962b) followed Yamamoto & Habe and used *Musculista* as a subgenus of *Musculus* Röding. Kira (1962a) placed it as a subgenus of *Brachidontes* Swainson. Most recent authors have given *Musculista* full generic status. I follow this practice on the advice of Dr Wilson who informs me that, in his opinion, *Musculista, Brachidontes* and *Musculus* are not congeneric and the former two do not even belong in the same subfamily of the Mytilidae (Wilson pers. comm.).

The shells figured as *Musculus senhousia* by Abbot & Dance (1982) are misidentified. They appear, by their elongate shape, to be *Musculista japonica* (Dunker).



Figs. 1-2. *Musculista senhousia* (Benson in Cantor). 1. Left valve from Motukaraka Island, Tamaki Strait, Auckland, 23.2 mm. 2. Left valve from Ngataringa Bay, Waitemata Harbour, Auckland, 21 mm.

DESCRIPTION

Shell (Figs. 1,2) maximum length 29 mm. Shape elongate to elongate-ovate; anterior end normally rounded; dorsal margin straight, reaching a height above that of umbones; posterior end flaring, broadly rounded; ventral margin straight or weakly concave; margins completely smooth except anterior one which is indistinctly crenulate. Shell very thin, equivalve, cylindrical, considerably inflated centrally, yet compressed posteriorly when viewed from above. Umbones small, subterminal (approximately one-tenth distance back from anterior end), prosogyrate. Ligament internal, opisthodetic, elongate and thin, deeply set on weak nymphs; resilium entire. Hinge edentulous (i.e., without true teeth) but with dysodont teeth before and behind ligament. Inner margin of anterior dorsal end with 6 to 10 small teeth close to the umbo; entire dorsal margin bearing small oblique teeth — 32 to 36 weaker ones above ligament and 9 to 11 stronger ones behind ligament; teeth alternate between valves and interlock when valves close.

Exterior smooth except for 6 to 10 broad radial ridges (obsolete in some shells) at anterior end extending from umbo to margin; rest of shell with fine, close concentric growth striae and occasional strong concentric ridges representing successive growth phases. Scars of adductor and retractor muscles and pallial line hardly discernible. Exterior covered uniformly by a thin, translucent, olive-green, smooth periostracum; marked with a series of irregular, undulating, concentric, purplish-brown zig-zags that become straight near the dorsal margin and are crossed, on the dorsal slope, by many, narrow, uninterrupted, reddish radial lines. Interior with a thin nacre, but highly lustrous nevertheless; creamish, barred throughout with purplish-red wavy lines and often (particularly in adults) stained with a large, violet blotch centrally.

Animal (Fig. 3) with anterior adductor elongate, narrow, situated close to mantle margin at anteroventral floor of shell valves. Posterior adductor rather large, ovate; located close to shell's dorsal margin posteriorly; conspicuously divided into equal smooth and striated portions that meet at an oblique junction. Pedal and byssal retractor muscles as in *Modiolus.* Anterior pedal retractors well developed but rather small, elongate, inserted close to margin at anterior end immediately below umbones. Posterior byssal retractors very large, elongate, attached to shell immediately above posterior adductors which they touch. Posterior pedal retractors large (but relatively smaller than posterior byssal retractors); attached directly in front of posterior byssal retractors (from which they are separated by a very small gap posteriorly); extending below pericardium to middle of shell. Anteriorly those two sets of retractors arise contiguously at origin of foot/byssus complex. Siphonal retractor muscle originates from lower posterior section of posterior adductor, runs (as a very thin strand) obliquely, lying against mantle and inserts at base of siphonal area of inner mantle fold. Foot relatively elongate and narrow; ventral surface with a longitudinal byssal gland groove; tip flattened dorsoventrally and rounded; colour cream, lightly suffused with superficial brown pigment dorsally and ventrally.

All three mantle lobes smooth; not fused along ventral margin from the anterior sixth of animal's length (where inner folds fuse) just behind anterior adductor muscle to extreme posterior end where inner lobes again fuse at base of exhalent opening. No indication whatsoever of fusion or increased muscularisation of mantle lobes around inhalent opening (as would constitute an inhalent siphon). Posteriorly, in area of inhalent opening, the inner mantle lobe bears a series of compound papillae; mantle and papillae chocolate brown with small, irregular areas of intense white pigment; large vertical branchial septum present within inhalent aperture. Exhalent siphon with a thin-walled complete margin; slightly elevated above inner mantle lobe; two thin valves block siphonal aperture from within, dorsal flap being closer to aperture, gap between them a narrow transverse slit.

Ctenidia large (extending full length of mantle cavity); filibranchiate, homorhabdic. In each gill, descending lamellae are a little longer than ascending ones — descending lamellae of outer demibranch being largest of all. Ascending lamellae of outer demibranch not fused with mantle but those of inner demibranch connected by ciliary junction to visceral mass. Labial palps large, elongate (reaching level with anterior edge of foot/byssus complex when extended posteriorly, i.e., about one-third length of mantle cavity), relatively narrow; inner faces strongly vertically plicate. Renal and genital apertures on separate papillae that open contiguously on roof of mantle cavity two-thirds of way back, just in front of level of anterior end of posterior adductor muscle.

Sexes separate. Gonadial tubules lie dorsally over digestive gland at anterior half of body in front of pericardium and invest most of mantle walls. No mesosoma in midline behind foot/byssal complex.

B. Morton (1974) has described the ciliary currents of the mantle, visceral mass and foot as well as the structure of the organs of the alimentary canal. *Musculista senhousia* is unique amongst mytilids hitherto examined in having the style sac

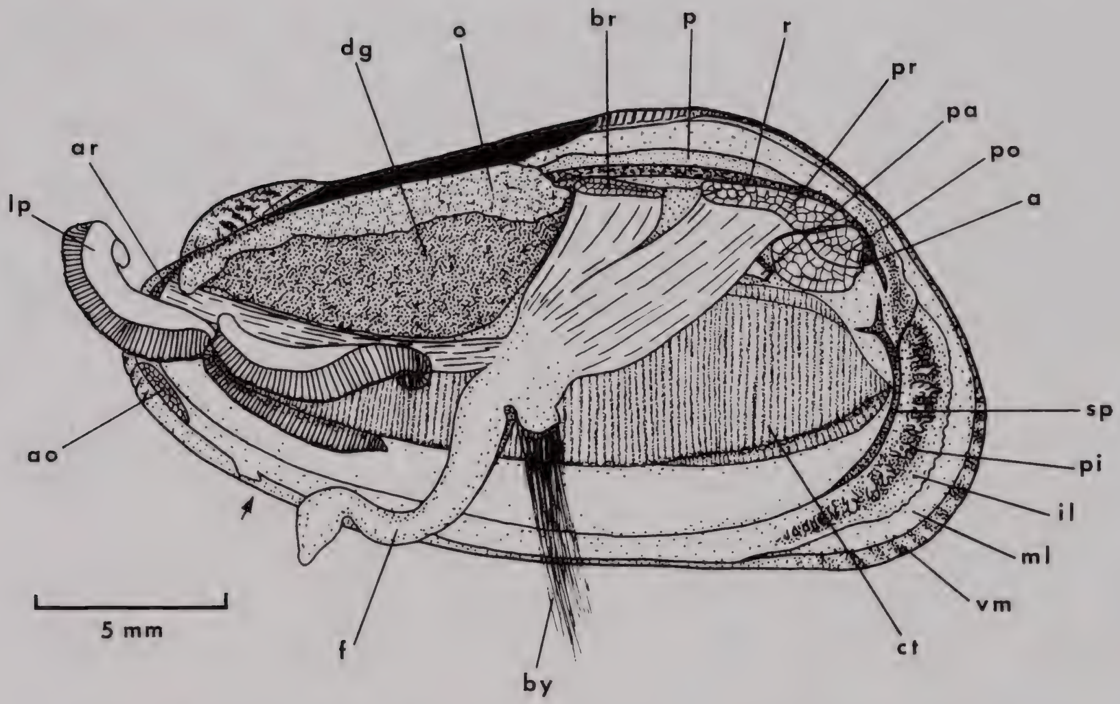


Fig. 3. *Musculista senhousia* (Benson in Cantor). Anatomy of the mantle cavity from the left side; left valve, mantle lobe and ctenidium removed. Arrow at front indicates point of separation of inner mantle lobes. Abbreviations: a, anus; ao, anterior adductor muscle; ar, anterior pedal retractor muscle; br, byssal retractor muscle; by, byssus; ct, (inner demibranch of) ctenidium; dg, digestive gland; f, foot; il, inner lobe of mantle; lp (outer) labial palp; ml, middle lobe of mantle; o, ovary; p, pericardium; pa, excretory and genital papillae; pi, papillae on (exhalent area of) inner mantle lobe; po, posterior adductor muscle; pr, posterior pedal retractor muscle; r, rectum; sp, septum; vm, valve margin.

separated from the midgut. Ieyama (1977) has described the karyotype of *M. senhousia,* for which the diploid chromosome number is 30 and the haploid number is 15.

A juvenile pinnothereid crab, probably *Pinnotheres novaezelandiae* Filhol, was living in the mantle cavity of one specimen of *Musculista senhousia* that I dissected.

ECOLOGY AND DISTRIBUTION

Musculista senhousia is widely distributed in eastern Asia where it occurs naturally from Singapore to the Siberian coast (Chuang 1961; Kikuchi & Tanaka 1978). Its abundance throughout this range has facilitated numerous ecological studies and these have been summarised by Kikuchi & Tanaka (1978). Briefly, B. Morton (1974) recognised discrete age classes within a population in Tai Tam Bay, Hong Kong; maximum density at this site was 2500 per m^2. Kikuchi & Tanaka (1978) found *M.*

senhousia not only to share numerical dominance with *Theora lubrica* (with maximum density of *M. senhousia* about 750 per m^2) but also to be "overwhelmingly dominant" in terms of biomass (accounting for 42-94% of total biomass) within Tomoe Cove, Tamioka Bay, Amakusa Shimoshima Island on the west coast of Kyushu Island, Japan. In the same year, these authors published further studies on productivity of *M. senhousia* in Tomoe Bay (Tanaka & Kikuchi 1978). In 1978 also, Kulikova described the morphology, seasonal population dynamics and settlement of larvae in the Brusse Lagoon, Aniva Bay, Sea of Okhotsk, Russia (Kulikova 1978). Larvae were numerous in the plankton of the lagoon during the months of highest sea temperatures with a maximum density of 17000 per m^3 and spat settled in greater numbers than any other bivalve.

Several common themes emerge from these ecological studies on *Musculista senhousia.* One is the mussel's considerable fecundity which, together with its gregarious habit, leads to high population densities being attained. Others are the rapid growth rate and the tendency for populations to fluctuate widely and unpredictably in time; in some years there are enormous populations at particular localities but in others *M. senhousia* can be completely absent. Both B. Morton (1974) and Kikuchi & Tanaka (1978) documented the complete disappearance of their entire study populations within a few months. The latter workers suggested the disappearance could have been caused by severe oxygen depletion in bottom waters that resulted from summer stratification.

Observations on *Musculista senhousia* in New Zealand indicate two apparently contradictory facets of its behaviour ("nest" building). On low sandstone reefs, which are uncovered at low tide, individuals were found amongst the algae *Hormosira banksii* and *Corallina officinalis,* and invariably alongside the small colonial mussel *Xenostrobus pulex.* Each was stayed in a near-vertical orientation by its byssus, nestling amongst the *Corallina* algal turf or within the extensive beds of *Xenostrobus.* On the sides and floor of silty pools individuals were living side by side, completely surrounded by a continuous weft ("nest") of interwoven byssal threads, tiny shell fragments and entrapped silt. Previous accounts have indicated that *Musculista senhousia* was sometimes found with (Kira 1962b; B. Morton 1974; Kikuchi & Tanaka 1978) or sometimes without (Hanna 1966) a byssal "nest". Obviously this mussel is flexible as regards formation of a "nest"; one is produced when required (as in silty pools or on soft substrates) but no "nest" is made when *M. senhousia* lives on hard substrates where it is in company with other clustering organisms or amongst dense algal turfs. There is no doubt that this species lives in two different habitats.

In December 1984 and January 1985 many beaches on Auckland's east coast were checked for *Musculista senhousia.* More dead shells than live specimens were present as indicated in Table 1. There was not time to search subtidally for this mussel.

Detailed investigations were made on the density of *Musculista senhousia* at one locality at which it had been observed as being maximally abundant, i.e., Motukaraka Island. There, on January 4, 1985, three 1 m^2 quadrats were searched exhaustively to get an exact measure of the mussel's numbers. All three quadrats were on the extensive intertidal reef platform on the northeastern side of the island (see Willan 1979 for a description of the locality) and each was deliberately selected as being within

Table 1. Localities and abundance of *M. senhousia.*

Locality	Abundance	Remarks
Matakatia Bay (southern end), Whangaparaoa Peninsula	Rare	1 live and 2 dead shells.
Castor Bay, lower Auckland Harbour	Absent	
Marine Parade, Devonport, lower Auckland Harbour	Absent	
Ngataringa Bay (southern end) lower Auckland Harbour	Rare	Many dead shells.
Farm Cove Yacht Club Shore, Tamaki Estuary	Common	Many dead shells.
Eastern Beach, near Howick, Tamaki Strait	Rare	Several dead shells
Howick Beach (northern end), Tamaki Strait	Common	Many dead shells.
Mellons Bay, Tamaki Strait	Abundant	Many dead shells.
Cockle Bay, Tamaki Strait	Absent	1 dead shell only.
Shelly Bay (northern end), Tamaki Strait	Absent	
Motukaraka Island, Tamaki Strait	Abundant	Many dead shells.
Puriri Bay (western end), Beachlands, Tamaki Strait	Rare	Few dead shells.

Abundant = more than 50 live specimens observed during 30 minutes searching in suitable habitats. Common = 10 to 40 live specimens observed during 30 minutes searching in suitable habitats. Rare = less than 10 live specimens found during entire search.

an area of maximum *M. senhousia* density. Besides recording the number of live *M. senhousia* in each quadrat, counts of the other two co-occuring mytilids, *Xenostrobus pulex* (Lamarck) the little black mussel and *Perna canaliculus* (Gmelin) the green-lipped mussel were also made. Results are presented in Table 2.

Table 2. Numbers of mytilids at Motukaraka Island.

	Quadrat 1	Quadrat 2	Quadrat 3
Musculista senhousia	10	6	2
Xenostrobus pulex	2800	4500	3600
Perna canaliculus	27	29	97

The figures in Table 2 demonstrate that, in early 1985, *Musculista senhousia* was living at a density of 6 per m^2, which was almost eight times less common than *Perna canaliculus* (all of which incidentally, were juveniles less than 40 mm in length) and very approximately four hundred and fifty times less common than *Xenostrobus pulex*. Dead shells of *M. senhousia* were much commoner than living specimens, the mean density of those being 59 per m^2. Because of their fragility, it is probable that dead valves of *M. senhousia* are never transported more than a few metres from the site where the animal lived before they disintegrate. Probably subtidal surveys or counts of specimens in "nests" on soft substrates would have yielded much higher densities in localised patches.

At present, this density recorded for one New Zealand population is well below the maximum, or at least that which *Musculista senhousia* has been found to be capable of in Asian waters. B. Morton (1974) reported numbers of up to 2500 per m^2 in Hong Kong.

No juvenile or subadult specimens (i.e., individuals with shells less than 15 mm long) were found live on this survey. All the living specimens collected proved, on dissection, to be sexually mature adults. This observation indicates the entire population at Motukaraka Island represented a single age class.

It is not known exactly how and when *Musculista senhousia* was introduced into Auckland. Professor J.E. Morton discovered two live specimens on the narrow intertidal reef platform at the front of the road at Black Reef, Westmere, upper Auckland Harbour in May 1980. Mr N. Douglas has a fresh, whole shell in his collection which was found at Puru, Thames by Mesdames M. and D. Bramley in November 1980. Because of the small number of specimens that these first records are based on, it seems likely *M. senhousia* arrived in New Zealand in the mid to late 1970s. However the considerable distance between Auckland Harbour and Thames indicates *M. senhousia* had already spread throughout Tamaki Strait by 1980. Shells collected by some vigilant Auckland conchologists since 1980 document its establishment and rapid dispersal. Mrs M. Morley found several specimens in the Tamaki Estuary (on the shore off Fisher Parade) on 14 August 1982. Mrs C. McLoughlin found many specimens at Omana Beach, near Maraetai, Tamaki Strait on 28 August 1983. Mr D. Snook observed large numbers washed ashore at Little Bay, Kaiaua, north of Miranda, Thames after a northerly storm on 25 February 1984. Mrs P. Town found several specimens washed up at Miranda, Thames in November 1984. As this paper was being written, I received advice from Mrs M. Morley in Auckland that she had located "hundreds of *Musculista senhousia* alive in thick matted beds covered with silt and quite invisible" near the yacht club between Little Bucklands and Bucklands Beach in Tamaki Estuary.

There are no known collections of *M.senhousia* from the Manukau Harbour, west of Auckland, and the present limits of distribution in New Zealand are unknown.

Musculista senhousia has also successfully invaded other parts of the world. It was first reported in California in 1944 (A.G. Smith 1944) and is now well established there (Hanna 1966). It is apparently still spreading and has recently colonised San Diego Harbour (B. Wilson pers. comm.). Kincaid (1947) found *M. senhousia* in abundance at Puget Sound, Washington. In January 1983 came the discovery of a population in the Swan Estuary, Perth, Western Australia by Mrs A. Brearley. Two of the other bivalves introduced to New Zealand, *Crassostrea gigas* and *Theora lubrica,* have also become established in California (Hanna 1966; Seapy 1974).

DISCUSSION

Four species of exotic bivalves have recently arrived in, and spread rapidly between, New Zealand harbours (particularly northern North Island); they are *Theora lubrica* Gould, *Limaria orientalis* (A. Adams & Reeve), *Crassostrea gigas* Thunberg (Powell 1976) and *Musculista senhousia* (Benson in Cantor). Because of the sites of presumed first introduction (i.e., collection), rapidity of dispersal, and magnitude of their populations, this kind of establishment of new species in New Zealand is quite different from the gradual arrival of foreigners as larvae with oceanic currents from the northwest. This latter process has resulted in the introduction of many temperate and subtropical eastern Australian species into northern New Zealand coastal waters; some have established (Powell 1976) and many must have perished. This natural process has probably operated throughout the Tertiary (at least) and resulted in the influxes of many species during periods of increased sea temperatures. However another method of arrival must be invoked for the bivalves in question (and several other exotic invertebrates, see Dromgoole & Foster 1983). In these cases, the evidence points overwhelmingly to their accidental introduction by shipping from Japanese ports. *Crassostrea gigas* is perhaps an exception; it may have been imported deliberately (Dromgoole & Foster 1983). Exactly how such introductions occur (i.e., attached to vessel's hulls or in ballast water) is uncertain but the number of invading species, their first establishment in harbours and their simultaneous arrival in ports of other countries around the world makes an hypothesis of establishment by natural larval dispersal (e.g., Climo 1976; Beu 1977) highly doubtful for these particular species. It is in fact, difficult to conceive the arrival of these species as anything but man-aided.

There is also other evidence supporting the argument for introduction by shipping, and specifically shipping from Japan. Data on shipping movements in Auckland Harbour given by Droomgoole & Foster (1983) show there was a marked increase between 1970 and 1979 in the number of vessels for which Auckland was the first port of call after a direct run from a Japanese port. Records indicate the establishment in Auckland during the same period and since, of no less than six additional marine invading organisms, both plants and animals, that were previously known from Japan: the algae *Codium fragile tomentosoides* (Van Goor) Silva and *Colpomenia bullosa* (Saunders) Yamada, the actiniarian *Sagartia luciae* Verrill, the brachyuran *Pyromaia tuberculata* (Lockington) and the nudibranchs *Okenia plana* Baba and *Thecacera pennigera* (Montagu) (Dromgoole 1975; Willan 1976; Parsons 1982; Dromgoole & Foster 1983; Willan & Coleman 1984). The arrival of a "cargo" of Japanese organisms (particularly barnacles) into New Zealand has also been recorded (Foster & Willan 1979), though the vessel was unconventional – an enormous floating oil platform.

A prerequisite for any colonising species is that it be opportunistic. *Musculista senhousia* possesses many attributes, notably its fast growth rate and high reproductive capacity (B. Morton 1974), that warrant its classification as an opportunist. Besides these properties, is the unique ability of this mussel to colonise both hard and soft substrates. Dr B. Morton has vividly described this process and its consequences. When colonising soft substrates, *M. senhousia* weaves its byssal threads into an all-enclosing protective "nest". This behaviour enables it to build up dense sheets with numbers of up to 2500 per m^2 on sand flats. Under such circumstances the colony rapidly changes the habitat into a mud flat through the stabilisation of the sand grains by byssal "nests" together with copious production of mucous-bound faeces and pseudofaeces. Deep-living infaunal species such as bivalves are excluded from these newly-formed mud flats because they cannot project their siphons through the compacted mussel colony to reach the water above. Thus there is a drastic alteration in the local fauna.

All the harbours of the northern North Island possess extensive sand flats which appear conducive to mat formation by *Musculista senhousia,* so its presence in New Zealand should be viewed with concern.

Acknowledgements: I am grateful to Mr W.O. Cernohorsky, Auckland Institute and Museum, for access to molluscan collections and to literature. Dr B.R. Wilson verified my identification of *Musculista senhousia* and provided information on the spread of this species around the world. Mrs M. Morley, Professor J.E. Morton and Mr N. Douglas kindly supplied their records of this mussel in New Zealand, as did Mrs A. Brearley for Western Australia. Mrs J.D. Willan and Miss G.V. Maynard were willing field assistants in Auckland. Professor J. Kikkawa kindly translated Japanese papers for me.

REFERENCES

ABBOT, R. T., and S. P. DANCE
1982 *Compendium of Seashells.* New York. 411p.

BENSON, W. H.
1842 Mollusca. Pp. 486-490, Addendum no. 5 to T. Cantor. General features of Chusan with remarks on the flora and fauna of that island. *Ann. Mag. Nat. Hist.* 9: 265-278; 361-370; 481-493.

BEU, A. G.
1977 Fossil History of *Limaria orientalis* in New Zealand. *Auckland Mus. Conch. Sec. Bull. (New Series)* 2: 1-7.

CHUANG, S. H.
1961 *On Malayan Shores.* Singapore. 225p.

CLIMO, F. M.
1976 The occurrence of *Theora (Endopleura) lubrica* Gould, 1861 (Mollusca: Bivalvia: Semelidae) in New Zealand. *Auckland Mus. Conch. Sec. Bull. (N.S.)* 1: 11-16.

DROMGOOLE, F. I.
1975 Occurence of *Codium fragile* subspecies *tomentosoides* in New Zealand waters. *N.Z. J. Mar. Freshwater Res.* 9: 257-264.

DROMGOOLE, F. I., and B. A. FOSTER
1983 Changes to the marine biota of the Auckland Harbour. *Tane* 29: 79-96.

FOSTER, B. A., and R. C. WILLAN
1979 Foreign barnacles transported to New Zealand by an oil platform. *N.Z. J. Mar. Freshwater Res.* 13: 143-149.

HABE, T.
1977 *Systematics of Mollusca in Japan: Bivalvia and Scaphopoda.* Tokyo. 372p.

HANNA, G. D.
1966 Introduced mollusks of western North America. *Occas. Pap. Calif. Acad. Sci.* 48: 1-108.

HICKMAN, R. W.

1983 An annotated bibliography of New Zealand marine mussels (Mytilidae), 1880-1982. *Occas. Publ. Fish. Res. Div.* (New Zealand) 40: 1-44.

IEYAMA, H.

1977 Studies on the chromosomes of two species of Mytilidae (Pteriomorphia, Bivalvia). *Venus JPN. J. Malacol.* 36: 25-28.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

1961 *International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology.* London. 176p.

KIKUCHI, T., and M. TANAKA

1978 Ecological studies on benthic macrofauna in Tomoe Cove, Amakusa I. Community structure and seasonal change of biomass. *Publ. Amakusa Mar. Biol. Lab. Kyushu Univ.* 4: 189-213.

KINCAID, T.

1947 The acclimatization of marine animals in Pacific northwest waters. *Minutes Conch. Club Southern Calif.* 72: 1-3.

KIRA. T.

1962a *Coloured Illustrations of The Shells of Japan. Enlarged and Revised Edition.* Osaka. 239p.

1962b *Shells of the Western Pacific in Colour.* Osaka. 224p.

KULIKOVA, V. A.

1978 Morphology, seasonal population dynamics and settlement of larvae of the lamellibranch *Musculista senhousia* in the Busse Lagoon (South Sakhalin). *Biol. Morya. Vladivostok.* 4: 61-66.

MORTON, B.

1974 Some aspects of the biology, population dynamics, and functional morphology of *Musculista senhausia* Benson (Bivalvia, Mytilidae). *Pacific Sci.* 28: 19-33.

PARSONS, M.

1982 *Colpomenia* (Endlicher) Derbès et Solier (Phaeophyta) in New Zealand. *N.Z. J. Bot.* 20: 289-301.

POWELL, A. W. B.

1976 On the considerable influx of warm water molluscs that have invaded northern New Zealand waters within recent years. *Rec. Auckland Inst. Mus.* 13: 141-166.

1979 *New Zealand Mollusca: Marine, Land and Freshwater Shells.* Auckland. 500p.

REEVE, L.

1857 *Conchologia Iconica 10; No. 11 Monograph of the genus Modiola.* London. pp. 1-11.

SEAPY, R. R.

1974 The introduced semelid bivalve *Theora (Endopleura) lubrica* in bays of southern California. *Veliger.* 16: 385-387.

SMITH, A. G.

1944 *Volsella senhausi* Reeve in Bolinas Bay, California. *Minutes Conch. Club Southern Calif.* 39:18.

TANAKA, M., and T. KIKUCHI

1978 Ecological studies on benthic macrofauna in Tomoe Cove, Amakusa I. Production of *Musculista senhousia (Bivalvia, Mytilidae). Publ. Amakusa Mar. Biol. Lab. Kyushu Univ.* 4: 215-233.

WILLAN, R. C.
1976 The opisthobranch *Thecacera pennigera* (Montagu) in New Zealand with a discussion on the genus. *Veliger* 18: 347-352.
1979 *The Ecology of two New Zealand opisthobranch molluscs.* Unpubl. PhD thesis, University of Auckland. 278p.

WILLAN, R. C., and N. COLEMAN
1984 *Nudibranchs of Australasia.* Sydney. 56p.

YAMAMOTO, G., and T. HABE
1958 Fauna of shell-bearing mollusks in Mutsu Bay. Lamellibranchiata (1). *Bull. Mar. Biol. Stn Asamushi, Tohoku Univ.* 9(1): 1-20.

LACEWINGS AND AQUATIC INSECTS OF NEW ZEALAND

3. Fauna of Poor Knights Islands

K. A. J. Wise

AUCKLAND INSTITUTE AND MUSEUM

Abstract. Results from a December 1980 expedition to Tawhiti Rahi Island, Poor Knights Islands, are given together with other known records and information for the island group. Although these islands are known for endemic species amongst other insects, none have been recognised amongst the lacewings and aquatic insects specifically determined so far.

The terrestrial arthropod fauna of the Poor Knights Is has been discussed and listed by Somerfield (1973), Kuschel (1982), Watt (1982) and Court (1983). In number two of the present series (Wise 1983), the lists included previously published records (one species only) and specimens recorded below for these islands.

The Poor Knights Is comprise two main islands, the northern Tawhiti Rahi I and the southern Aorangi I, and several islets, *ca.* 20 km off the eastern coast of North Auckland, north of the Whangarei Harbour. Tawhiti Rahi I is elongate with ephemeral streamlets on a forested northern plateau and a larger stream, lower down, almost traversing the island to Shag Bay and bordering the more open land at the southern end (see description and maps in Hayward & Hayward 1983).

The present author accompanied the Entomology Division (D.S.I.R.) expedition to the cliff-ringed Tawhiti Rahi I in late 1980, the camp being sited, above one of the few landing spots, on a ledge in Shag Bay.

Even though it was still early summer (1-11 December 1980) the southern stream had stopped flowing, although it had been flowing well in September that year (J.C. Watt pers comm.). Several pools remained in the stream bed so specimens recorded here are mainly from these.

Above the low cliffs to the sea were two larger pools, designated ‘bottom pool’ and ‘crossing pool’, and four smaller ones, ‘A’, ‘B’, ‘C’, ‘D’, all within *ca.* 20 m where there was little gradient. Bottom pool (1 m in length) and crossing pool (2 m in length) were shaded stagnant pools in rock, both containing leaf and branch debris and with a strong smell. The fauna included large populations of mosquito larvae (2 species) together with midge and beetle larvae, and pond skaters on the surface. Of the small

Rec. Auckland Inst. Mus. 22: 97-103 18 December 1985

pools, A was in rock, shaded and containing leaves, B in soil and completely shaded, C in rock, a shallow open pool, and D in rock, 1 m deep and open. The fauna of the shaded pools A and B included mosquito larvae (1 species) and beetle larvae, of the open pools C and D, beetle larvae and pond skaters.

Further up the stream bed above a flax patch and below the junction (*ca.* 100 m from the cliffs) was a clear partly shaded pool in rocks which contained a few beetle larvae and small mosquito larvae (not collected), and also the only Ceratopogonid and Tabanid larvae taken.

A few other aquatic species were collected either as adults or immatures. The sea coast also provided records of marine caddis flies and coastal mosquitoes. Two species of lacewings were collected on Tawhiti Rahi I during the expedition.

Specimens were collected and/or determined by the author and are in the Auckland Museum collection (AMNZ) unless otherwise indicated. Some are in the New Zealand Arthropod Collection (NZAC), Entomology Division.

ODONATA

COENAGRIONIDAE

Ischnura aurora aurora (Brauer, 1865)

Tawhiti Rahi I: Shag Bay, 1.XII.1980 (1♀).

This species, previously recorded by Wise (1983) from this adult specimen, may be only an occasional visitor from the mainland as noted for other islands (Wise 1983: 260).

HEMIPTERA

VELIIDAE

Microvelia macgregori (Kirkaldy, 1899)

Tawhiti Rahi I: main stream, pool, 3.XII.1980 (3), bottom pool, 10.XII.1980 (17), crossing pool, 10.XII.1980 (9), pool C, 10.XII.1980 (4), pool, 10.XII.1980 (6).

Wise (1983) recorded the species from these specimens which include both adults and immatures.

NEUROPTERA

HEMEROBIIDAE

Drepanacra binocula (Newman, 1838)

Tawhiti Rahi I: below lighthouse, in forest, 8.XII.1980 (1♂), plateau 200 m, main track, swept, 8.XII.1980 (1♂).

(NZAC). Tawhiti Rahi I: ex *Beilschmedia,* 7.XII.1980 (1♂), 8.XII.1980 (1♂), G. Kuschel.

Previously recorded (Wise 1983) on the basis of these specimens and is probably established.

Micromus tasmaniae (Walker, 1860)

Tawhiti Rahi I: plateau 200 m, swept, 2.XII.1980 (3♀♀), plateau, main track, swept, 7.XII.1980 (1♀), lighthouse area 150 m, swept, 8.XII.1980 (1♂).

(NZAC). Tawhiti Rahi I: pan trap in bush, 2-10.XII.1980 (1♂), window trap in bush, 2-10.XII.1980 (1♀), Tawa knoll, swept at night, 9.XII.1980 (1♀), M.F. Tocker; SE. track, malaise trap in bush, 3-10.XII.1980 (1♂), RH. Kleinpaste; on *Xeronema,* 2.XII.1980 (1♀), 8.XII.1980 (2♂♂ 1♀), ex *Phormium tenax* swamp, 10.XII.1980 (2♂♂ 1♀), G. Kuschel; rushes, *Cassinia,* swept, 11.XII.1980 (1♀), C.F. Butcher. Aorangi I: 30 m above camp, to light, 10.XI.1981 (1♀), Crater valley saddle, at night, 13.XI.1981 (2♀♀), Crater Bay, forest N. side, at night, 15.XI.1981 (1♀), Crater Bay, malaise trap in coastal scrub, 11-16.XI.1981 (3♀♀), J.S. Dugdale.

Previously recorded (Wise 1983) from these adults and is probably established.

Immature. (NZAC). Tawhiti Rahi I: N. track, beating *Corynocarpus laevigatus,* at night, 7.XII.1980 (1 larva), C.F. Butcher.

This larva is not yet specifically determined.

COLEOPTERA

SCIRTIDAE (= HELODIDAE)

Immatures. Tawhiti Rahi I: main stream, pool, on dead leaves, 3.XII.1980 (8 larvae), pool D, 6.XII.1980 (1 larva), bottom pool, 10.XII.1980 (2 larvae), crossing pool, 10.XII.1980 (4 larvae), pool A, 10.XII.1980 (5 larvae), pool B, 10.XII.1980 (9 larvae), pool C, 10.XII.1980 (9 larvae), pool D, 10.XII.1980 (32 larvae), upper stream bed pool, 11.XII.1980 (1 larva).

The record of this family by Wise (1983) was given for these aquatic larvae which are easily recognised.

Cyphon sp. (Det. by J.C. Watt)

Tawhiti Rahi I: main stream, swept, 1.XII.1980 (4), above stream below crossing, swept, 4.XII.1980 (1), by stream, 6.XII.1980 (1), upper stream bed, swept, 11.XII.1980 (1).

These non-aquatic beetles may not be adults of the aquatic larvae but are included for the record.

HYDROPHILIDAE

Cercyon haemorrhoidalis (Fabricius) (Det. by R.G. Ordish)

Tawhiti Rahi I: main stream, on surface of pool, 4.XII.1980 (1).

Many species of this family are aquatic but this beetle is of a non-aquatic species which, however, is included for the record. Other non-aquatic beetles were also found on pools.

DIPTERA

CULICIDAE

Culex (Culex) pervigilans Bergroth, 1889

Tawhiti Rahi I: main stream, bottom pool, 10.XII.1980 (many larvae), crossing pool, 10.XII.1980 (many larvae).

The two pools recorded contained very large numbers of mosquito larvae which were obviously of two species. However, no adults of this species were taken and the record by Wise (1983) was based on these larvae.

Opifex fuscus Hutton, 1902

Tawhiti Rahi I: E. track, at light, 6.XII.1980 (1♂), landing, rock pool above HWM, 11.XII.1980 (58 ♂♂ 20 larvae).

(NZAC) (Det. by T.K. Crosby)
Tawhiti Rahi I: camp, 6-8.IX.1980 (1♀), R. Grace; Shag Bay, 6-11.IX.1980 (1♀), J.C. Watt; Shag Bay, pan trap, 3-10.XII.1980 (2♂♂), landing 8.XII.1980 (2♂♂ many imm.), rock pool, 9.XII.1980 (11♂♂), M.F. Tocker; to light, 6.XII.1980 (1♀), Tawa knoll, to light, 8.XII.1980 (2 ♀♀), R.H. Kleinpaste. Aorangi I: -.XI.1981 (2♂♂ 2 ♀♀), J.S. Dugdale.

This is the widespread coastal mosquito previously recorded for Poor Knights Is by Somerfield (1973), Watt (1982) and, from the above AMNZ specimens, by Wise (1983).

Aedes (Ochlerotatus) antipodeus (Edwards, 1920)

Tawhiti Rahi I: by stream, swept, 1.XII.1980 (2♂♂ 2 ♀♀), lower main track, 2.XII.1980 (1♀), by stream, at light, 4.XII.1980 (5 ♀♀), main stream, bottom pool, 10.XII.1980 (1 ♂ 5 larvae), crossing pool, 10.XII.1980 (many larvae), pool A, 10.XII.1980 (2 larvae), pool B, 10.XII.1985 (14 larvae).

(NZAC) (Det. by T.K. Crosby)
Tawhiti Rahi I: vegetation, 4.XII.1980 (4♂♂), C.F. Butcher; main stream, stagnant pools, swept, 5.XII.1980 (2 ♂♂ 1♀), N. track, swept, 6.XII.1980 (6 ♂♂ 1♀), M.F. Tocker; *Phormium tenax* swamp, 10.XII.1980 (5♂♂ 2 ♀♀), G. Kuschel.

Wise (1983) recorded the species from the AMNZ specimens above.

CHIRONOMIDAE (Det. by D. Forsyth)

Chironomus zealandicus Hudson, 1892

Tawhiti Rahi I: by stream, at light, 4.XII.1980 (1♀), main stream, bottom pool, 10.XII.1980 (2 larvae, 1 larval exuviae, 1 pupa), crossing pool, 10.XII.1980 (3 larvae).

Bloodworms were numerous in bottom deposits of these pools.

Gressittius antarcticus (Hudson, 1892)

Tawhiti Rahi I: main stream, pool D, 10.XII.1980 (2 larvae).

Pentaneura sp.

Tawhiti Rahi I: main stream, crossing pool, 10.XII.1980 (1 larva).

Polypedilum sp.

Tawhiti Rahi I: by stream, swept, 1.XII.1980 (1♂).

This and the following Diptera families have not previously been recorded for the Poor Knights Is.

CERATOPOGONIDAE (Det. by D. Forsyth)

Forcipomyia sp.

Tawhiti Rahi I: main stream, upper stream bed pool, 11.XII.1980 (1 larva).

SCIOMYZIDAE

Tawhiti Rahi I: main stream, crossing pool, 10.XII.1980 (1 larva).

TABANIDAE

Tawhiti Rahi I: main stream, upper stream bed pool, 11.XII.1980 (1 larva).

Other Families

Several other undetermined larvae were taken in the stream bed pools. On the surface of pools were many small flies of the families Psychodidae, Sciaridae, Dolichopodidae, Stratiomyidae, Sphaeroceridae, Chloropidae and Helomyzidae but it is not known which of these may have aquatic larvae.

TRICHOPTERA

RHYACOPHILIDAE

Tiphobiosis plicosta McFarlane, 1960

Tawhiti Rahi I: by stream, at light, 4.XII.1980 (1♂).

This single adult may have been blown from the mainland as there was no sign of freshwater caddis larvae, but it could have been a late emergence if there had been larvae in the flowing stream.

CHATHAMIIDAE

Philanisus plebeius Walker, 1852

Tawhiti Rahi I: Shag Bay, camp, 1.XII.1980 (4♂♂), Shag Bay, camp, at light, 1.XII.1980 (10 ♂♂ 1♀), on shore, at light, 3.XII.1980 (3 ♂♂ 2 ♀♀), Shag Bay, at light, 5.XII.1980 (1♂), Shag Bay, at light, 9.XII.1980 (3♂♂).

(NZAC). Aorangi I: bush above camp, to light, 9.XI.1981 (1♂), J.S. Dugdale.

The common marine caddis fly was recorded from the above specimens by Wise (1983).

Discussion

The main stream at the southern end of Tawhiti Rahi I was found to be ephemeral and was not flowing at the time of the December 1980 expedition. Immatures of the aquatic Orders Ephemeroptera, Odonata, Plecoptera, Megaloptera and Trichoptera were not found.

Comments on the lacewing and aquatic insect faunas of the northern offshore islands made by the author previously (Wise 1983: 267) apply to the Poor Knights Is fauna. Although the Poor Knights are known for endemic species amongst some insects, mainly Orthoptera and Coleoptera, none has yet been recognised amongst the present group. All the determined species occur also on the North Island mainland. Two winged specimens, a damselfly and a caddis fly may have been wind-borne visitors from the same source.

Acknowledgements. The invitation to join the Entomology Division, D.S.I.R., expedition is much appreciated as are the assistance given by other expedition members and loans of specimens.

Drs J.C. Watt and T.K. Crosby, Entomology Division, Auckland, Dr D. Forsyth, Division of Marine and Freshwater Science, Taupo, and Mr R. G. Ordish, National Museum, Wellington, kindly examined some of the specimens and supplied information.

REFERENCES

COURT, D. J.

1983 Spiders from Tawhiti Rahi, Poor Knights Islands, New Zealand. *J. R. Soc. N.Z.* 12(4): 359-371.

HAYWARD, B. W., and G. C. HAYWARD

1983 Lichens of Tawhiti Rahi, Poor Knights Islands, northern New Zealand. *J. R. Soc. N.Z.* 12.(4): 373-379.

KUSCHEL, G.

1982 Apionidae and Curculionidae (Coleoptera) from the Poor Knights Islands, New Zealand. *J. R. Soc. N.Z.* 12(3): 273-282.

SOMERFIELD, K. G.

1973 Insects from the Poor Knights Islands, New Zealand. *Proc. N.Z. Ecol. Soc.* 20: 53-57.

WATT, J. C.

1982 Terrestrial arthropods from the Poor Knights Islands, New Zealand. *J. R. Soc. N.Z.* 12(3): 283-320.

WISE, K. A. J.

1983 Lacewings and aquatic insects of New Zealand. 2. Fauna of the northern offshore islands. *Rec. Auckland Inst. Mus.* 20: 259-271.

INDEX TO VOLUME 22

Adventive plants 41
Aedes (Ochlerotatus) antipodeus 100
Alliaria petiolata 42
Angklung 31
Annabell, Angela R.
  Javanese *angklung* in the Auckland Institute and Museum 31
Aquatic insects 97
Aradidae 77
Asian mussel 85
Aster laevis 44
Bangerter, E.B.
  New and interesting records of adventive plants from the Auckland Institute and Museum, Herbarium. 11 41
Bay of Islands 1
Brassica tournefortii 42
Calendula arvensis 44
Cercyon haemorrhoidalis 100
Cernohorsky, W.O.
  The taxonomy of some Indo-Pacific Mollusca. Part 12. With remarks on two American Gastropod species 47
Chicoreus aculeatus 47
Chicoreus trivialis 49
Chironomus zealandicus 101
Coriandrum sativum 43
Coralliophila violacea 51
Culex (Culex) pervigilans 100
Cuphea hyssopifolia 42
Cyphon sp 99
Drepanacra binocula 98
Engina mactanensis 53
Forcipomyia sp 101
Fox, Aileen
  Okuratope Pa, Waimate, Bay of Islands 1
Fumaria bastardii 41
Gill, B.J.
  Subfossil bones of a large skink (Reptilia: Lacertilia) from Motutapu Island, New Zealand 69
Glycymeris (Tucetona) pectunculus 64
Gressittius antarcticus 101
Hamineidae 63
Hypericum mutilum 43
Ischnura aurora aurora 98
Javanese *angklung* 31
Kirman, M.
  A new genus and species of Prosympiestinae (Hexapoda: Hemiptera: Aradidae) from Northland, New Zealand 77
Lacertilia 69
Lacewings 97
Mesadenocoris 78
Mesadenocoris robustus 80
Micromus tasmaniae 99
Microvelia macgregori 98

Mitra dondani 56
Mitrolumna (Cymakra) tallahalaensis 63
Motutapu Island 69
Musculista senhousia 85
Nassarius (Hima) rotundus 55
Nelson 17
Neocancilla takiisaoi 59
Northland 77
Okuratope Pa 1
Ononis spinosa spinosa 43
Opifex fuscus 100
Pentaneura sp. 101
Philanisus plebeius 102
Polypedilum sp. 101
Poor Knights Islands 97
Prickett, Nigel
  The twin-lobed pendant, an Archaic artefact from the Nelson district 17
Ribes odoratum 43
Scrophularia auriculata 44
Silene vulgaris maritima 42
Skink 69
Subfossil bones 69
Telopea oreades 42
Tiphobiosis plicosta 102
Twin-lobed pendant 17
Vexillum (Pusia) zythochroum 60
Waimate 1
Willan, R.C.
  Successful establishment of the Asian mussel *Musculista senhousia* (Benson in Cantor, 1842) in New Zealand 85
Wise, K.A.J.
  Lacewings and aquatic insects of New Zealand. 3. Fauna of Poor Knights Islands . 97

RECORDS AND BULLETIN OF THE AUCKLAND INSTITUTE AND MUSEUM

Instructions for Authors

The *Records* and *Bulletins* contain the results of original research dealing with material in the collections of the Museum, and research carried out by members of the Museum staff in their particular subjects. The fields covered are usually anthropology (archaeology and ethnology), botany, geology and zoology, although any aspect of the Museum's work and collections may be included.

Before completion of a manuscript, authors should refer to papers on a similar subject in the most recently published volume for detail of format required. Any doubts should be referred to the Editor. Standard rules for scientific papers and taxonomy apply; an acceptable guide for style is the New Zealand Government Printing Office Style Book (1981 edition).

Manuscripts should be typed, double-spaced on one side of white International A4 or foolscap sheets, with a 2.5 cm (or 1 inch) margin on *both* sides of page. Two copies of text are required, second copies of figures are preferred but not demanded. Manuscripts should not be in booklet form, but supplied with figures, figure captions, tables with captions above, all separate, with only an indication of position required in the text.

Abstracts are required except for brief papers with adequate title.

Figures (particularly groups of figures) and tables should be composed to page proportions, with due regard to saving space, and must be supplied ready for reduction (where necessary) to the printed page size or less (allowing for captions — above tables, below figures), preferably upright on page but sideways on page accepted (where necessary). Figures for fold-outs will only be allowed in special circumstances. Individual figures (whether grouped or not) should be numbered consecutively in arabic numerals (*not* 1a, b, c, etc) regardless of whether they are photographs or line drawings. Figures and tables *must* be referred to in the text and should be numbered in order of reference where possible.

All measurements must be given in metric (SI) units; equivalents in other units may be given in parenthesis.

Entries listed under "References" *must* be referred to in the text; this may not be necessary for a "Bibliography" or "Selected Bibliography" provided such listing is explained in the text. Book titles need not be abbreviated but names of journals should be abbreviated to known standards (as in "The world list of scientific periodicals" 4th edition, or as in the journal itself, or by a combination of recognised abbreviations), but need not be over-abbreviated. Names of countries may be abbreviated but those of cities or provinces are preferred not abbreviated. English titles of books and papers should be in lower case except for the first letter of names, but names of journals should have all major words beginning with a capital letter. Those of foreign languages should have capital letter usage of the language concerned.

Authors are responsible for the accuracy of their data, references and quotations, for their conclusions and remarks, and also for corrections to proofs. Authors (whether single or joint) will receive 50 free offprints each.

Papers may be offered to the Editor at any time but those received for the *Records* after 31st March of any year may not be considered for publication that year. All papers will be submitted to the Editorial Committee and may be submitted to a referee.

PRINTED BY UNITY PRESS